CONFERENCES

New Listings

July 10-13: **The Neuropharmacology of Serotonin,** Vista International Hotel, New York, NY. Contact: Conference Director, New York Academy of Sciences, 2 East 63rd St., New York, NY 10021, (212) 838-0230.

September 27-29: **EPRI Annual Utility Seminar on EMF Laboratory Research,** Lake Lawn Lodge, Delavan, WI. Contact: Robert S. Banks Associates, PO Box 14574, Minneapolis, MN 55414, (612) 623-4646.

October 2-8: **2nd International School on Electromagnetic Fields and Biomembranes,** Pleven, Bulgaria. Contact: Professor Marko Markov, Dept. of Biophysics and Radiobiology, Sofia University, 8 Dragan Tzankov Blvd., 1000 Sofia, Bulgaria.

October 4-6: **Medical Conference: Health and Medicine at Work in the Electricity Industry,** Barcelona, Spain. Contact: International Union of Producers and Distributors of Electrical Energy Secrétariat, 39, avenue de Friedland, FR-75008 Paris, France, (33) 1 40 42 37 08.

November 12-16: **DOE-EPRI Review of 50/60 Hz Biological Research,** Westin Benson Hotel, Portland, OR. Contact: W/L Associates, 120 W. Church St., Frederick, MD 21701, (301) 663-1915 (see p.9).

December 11-13: **9th Miami International Congress on Energy and Environment (9MICEE),** Miami Beach, FL. Contact: Lucille Walter, Clean Energy Research Institute, University of Miami, Coral Gables, FL 33124, (305) 284-4666.

1990

February 6-8: **6th Annual IEEE Semiconductor Thermal and Temperature Measurement Symposium,** Sunburst Resort Hotel, Phoenix, AZ. Contact: IEEE SEMI-THERM Symposium, c/o C/S Communications, PO Box 23899, Tempe, AZ 85285, (602) 967-7444.

February 13-15: **14th Symposium on Explosives and Pyrotechnics,** Holiday Inn Crowne Plaza, Burlingame, CA. Contact: E&P Affairs, Franklin Research Center, 2600 Monroe Blvd., Norristown, PA 19403, (215) 666-3026.

February 13-15: **Instrumentation/Measurement Technology Conference (IMTC),** ***Emerging Measurement Technologies,*** Red Lion Inn, San Jose, CA. Contact: Robert Myers, IMTC Conference Coordinator, 1700 Westwood Blvd, #101, Los Angeles, CA 90024, (213) 475-4571.

May 20-24: **1990 International Geoscience and Remote Sensing Symposium (IGARSS '90),** College Park, MD. Contact: Dr. James A. Smith, Code 623, NASA/Goddard Space Flight Center, Greenbelt, MD 20771, (301) 286-7282.

June 11-14: **Conference on Precision Electromagnetic Measurements,** Ottawa, Ontario, Canada. Contact: H. Lacoste, Conference Services, National Research Council of Canada, Ottawa, Ontario K1A 0R6, Canada, (613) 993-9009.

August 28-September 5: **23rd General Assembly of the International Union of Radio Science (URSI),** Praha, Czechoslovakia. Contact: Prof. V. Zima, Institute of Radioengineering and Electronics, Czechoslovak Academy of Sciences, 182 51 Praha 8, Czechoslovakia.

October 4-6: **International Conference on Harmonics in Power Systems,** Budapest, Hungary. Contact: Dr. Andras M. Dan, Budapest Technical University, Dept. of Power Systems, 1111 Budapest, Egry Jozsef u.18., Hungary, 361-666-438.

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MICRO WAVE NEWS

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EPA Staff Classifies ELF EMFs "Probable Human Carcinogens"

Decision Overruled, May Be Reinstated

Analysts at the U.S. Environmental Protection Agency (EPA) have recommended that extremely low frequency (ELF) electromagnetic fields (EMFs) be classified as "probable human carcinogens." Their recommendation was based on a two-year review of the health effects literature—primarily epidemiological studies.

By designating ELF EMFs as probable human carcinogens,* the EPA staff put them in a general class with PCBs, DDT and formaldehyde (see table, p.9).

The EPA staff also recommended that radiofrequency and microwave (RF/MW) radiation be designated as a "possible" carcinogen—in a class with saccharin.

Dr. William Farland, director of EPA's Office of Health and Environmental Assessment (OHEA), which prepared the report, ordered the ELF recommendation deleted in mid-March because of the absence of both a mechanism of interaction and an observed dose-response relationship. The RF/MW classification was also removed.

The document, *An Evaluation of the Potential Carcinogenicity of Electromagnetic Fields*, will now be issued without risk classifications, although it nonetheless concludes that ELF studies of leukemia, lymphoma and cancer of the nervous system among children and workers "show a consistent pattern of response that suggests, but does not prove, a causal link." (The complete text of the report's Summary and Conclusions appears on pp.11-15.)

(continued on p.9)

EPA's Original Conclusion: 60 Hz EMFs are 'B1' Carcinogens

As late as March 12, 1990, the paragraph below concluded the executive summary of the EPA report. A few days later, it was deleted.

"Concerning exposure to fields associated with 60 Hz electrical power distribution, the conclusion reached in this document is that such exposure is a 'probable' carcinogen risk factor, corresponding to a 'B1' degree of evidence that it is a risk factor. This conclusion is based on 'limited' evidence of carcinogenicity [in] humans which is supported by laboratory research indicating that the carcinogenic response observed in humans has a biological basis, although the precise mechanisms [are] only vaguely understood."

ELF NEWS

« Power Line Talk »

Woman's Day has encouraged its large readership to write to **EPA** Administrator **William Reilly** to reinstate the agency's research effort on EMF hazards. In fact, it went so far as to include a clip-and-mail coupon, addressed to Reilly, in its May 22 article, "Should You Be Worried About Electricity?" By the end of the month, EPA had received over 400 letters—not just coupons. After Dan Rather put the EPA cancer report (see p.1) at the top of the *CBS Evening News* on May 21 and the Associated Press and the *New York Times* followed up with their own stories, EPA's radiation office was deluged with calls—a few hundred a day, according to one senior EPA official. A couple of days later, the head of EPRI went to talk to Reilly about EMFs (see p.10). Even without all the publicity, Reilly had to be personally aware of EMFs. He and his family live in Old Town **Alexandria**, VA, two blocks from neighbors who are pressuring Virginia Power to reduce ambient magnetic fields from distribution lines—a controversy featured on ABC's *Nightline* (see *MWN*, J/F90 and M/A90). It's possible that even **President Bush** has now heard about EMFs: one of his sons and his family also live in Old Town.

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The **Department of Energy** (DOE) will transfer its long-term epidemiological research on **ionizing radiation** to the Department of Health and Human Services—following the recommendations of an independent advisory panel. The Secretarial Panel for the Evaluation of Epidemiologic Research Activities (SPEERA) was set up by DOE Secretary **James Watkins** in June 1989 to suggest ways of improving the credibility of the DOE's epidemiology program. In a March report, the panel called for the move in order to "restore public trust" and "assure independence of investigators." It noted that, "Because the department's role is to promote energy production, there is an inherent potential conflict between immediate production goals and health and safety goals." Indeed, some critics have long maintained that health-related studies do not belong in the DOE's domain. "It is...intolerable that the fox could have the exclusive right [or even the primary responsibility] for reporting on morbidity and mortality in the chicken coop," charged Dr. Jack Geiger of Physicians for Social Responsibility in the March 23 issue of *Science*. Among SPEERA's other recommendations are that health and safety work be consolidated within a newly-established DOE office of occupational health and that a policy of greater openness be instituted. The panel called for an additional $15 million in funding and for the DOE to address "many questions about non-nuclear energy-related risks" (see *MWN*, J/F90). A SPEERA spokeswoman told us that EMFs are on the panel's list. Copies of the SPEERA report are available from: DOE, Public Inquiries Branch, PA-5, Washington, DC 20585, (202) 586-5575.

«« »»

After six months, the school board and some parents want to discontinue the yearlong magnetic field measurement program at **Florida's Sandpiper Shores Elementary School**—albeit for different reasons. Following a court order, teachers at the Boca Raton school have been sporting EMDEX meters since November to monitor exposures from high-voltage lines near the school (see *MWN*, N/D89). "We really feel that the program should be terminated," Abbey Hairston, counsel for the Palm Beach County School Board, told us, citing the consistently low readings—averaging under 2 mG—since the program began. "It's costing us a great deal of money," she said. For their part, three parents, who last year sued to close down the school (see *MWN*, J/A89), want the court to suspend the program until the "kinks" are worked out. In April, their lawyer, Larry Marraffino, took their concerns to the court. Marraffino suspects that Florida Power & Light is "redirecting power," which would explain why the "readings have been very low at Sandpiper, lower than those taken two years ago." After all, he explained, since that time, the demand for electricity in the area has increased. Marraffino told us that the parents are willing to compromise: "We would be happy to have the board let concerned parents send their children to the next nearest school"—where there are no nearby power lines.

«« »»

Dr. **Granger Morgan** of Carnegie Mellon University is taking heat from all sides over his critical review of **Paul Brodeur's** book, *Currents of Death*, which appeared in the April 1990 issue of ***Scientific American***. On one side, Drs. **Eleanor Adair** and **Robert Adair**, in their own stinging critique, accuse Morgan of repeating some of the same scientific errors as Brodeur. In an as-yet-unpublished letter to *Scientific American*, the Adairs—mimicking Morgan's attack on Brodeur—charge that, "Morgan himself 'oversimplifies and misrep-

Paul Brodeur To Revisit EMF Issue in "The New Yorker"

Paul Brodeur will publish an update to his "Annals of Radiation" in the July 9 issue of *The New Yorker* magazine—on newsstands July 2. In this fourth feature-length installment on the hazards of EMFs, Brodeur will report on clusters of cancer, birth defects and other ailments among people living close to high-current power lines and electrical substations.

Brodeur published a three-part series on the health risks associated with power lines, radar and video display terminals (VDTs) in June 1989 (see *MWN*, M/J89). Last November, an expanded version of the *New Yorker* articles appeared in book form as *Currents of Death*.

resents...the scientific...evidence.' His description is as faulty as Brodeur's, and for the same reasons. And...his misrepresentations are even more harmful to society." The Adairs claim that many "senior scientists" believe that EMF effects are "not credible and that such effects verge on the impossible" and that the "electrophobia fed by Brodeur and Morgan has no better logical foundation than ESP or astrology." Adding to the fire, on June 5, New York City's ***Village Voice*** columnist James Ledbetter accuses both Morgan and *Scientific American* of omitting one key fact from the review: Morgan, who pats EPRI on the head for doing a "remarkably good job" in supporting unbiased high-quality EMF research, received a $300,000 contract from EPRI in 1988.

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BC Hydro *would* do it again. Vice President Chris Boatman told Canadian television that, if the utility had a second chance, it would still offer to buy the homes of people living along its high-voltage power line on Vancouver Island (see *MWN*, M/J89 and J/A89)—in spite of the British Columbia Utilities Commission's opinion that BC Hydro had acted "imprudently." Over at **Ontario Hydro**, Paul Newall told the CBC that he thought BC Hydro had overreacted. Newall said that it is "not an action that Ontario Hydro would contemplate at this point in time." The exchange was featured on the April 16 segment of the CBC's *The Journal*. By the end of May, BC Hydro had purchased 55 properties and planned to buy three more (see *MWN*, S/O89 and N/D89), according to BC Hydro's Peter McMullan. Supporting Boatman's position, McMullan told us, "We made the right decision at the right time."

Prenatal Electric Blanket Use Linked to Childhood Cancer

Children whose mothers used electric blankets during pregnancy had higher risks of brain tumors and leukemia, according to Dr. David Savitz and colleagues at the University of North Carolina, Chapel Hill. This is the first study to link electromagnetic fields (EMFs) from electric blankets to the development of cancer.

In a paper published in the May 1990 issue of the *American Journal of Epidemiology (131*, pp.763-773), Savitz and coworkers Drs. Esther John and Robert Kleckner report that the incidence of brain tumors among the offspring increased by two-and-a-half times—a statistically significant finding. There was a 70% increase in leukemia and a 30% increase for all cancers.

These electric blanket results "are another reason to take the [EMF] issue more seriously," Savitz told *Microwave News* in a telephone interview. Overall, he said, "It's part of the same constellation of evidence pointing in the same direction."

Responding to critics who have argued that some as-yet-undetermined factor was responsible for the increases in childhood cancer observed in past epidemiological studies on power line EMFs, Savitz said that these new results involved "a different exposure with different confounders, so you can't invoke the factor 'X' as has been done with wire codes. The potential source of biases would be different." (For more on this debate, see *MWN*, N/D88 and J/F89.)

The team did not observe any increase in childhood cancer due to prenatal exposures from water beds or from bedside electric clocks.

For those women who used electric blankets during the first trimester of pregnancy, there was a statistically significant 400% increase in brain tumors among their children. But Savitz cautioned that these findings were based on only a small number of cases.

Postnatal electric blanket use by children was also linked to a 50% increased risk of cancer. Here again, the number of cases was small. For acute lymphocytic leukemia, the increase was 90%—a "larger but imprecise association." Neither association was statistically significant.

The team concluded that, "It is noteworthy that the strongest evidence for positive associations was found for electric blankets, given the evidence that these devices are probably the home appliance with the greatest potential for producing elevated time-integrated exposures....electric blankets are associated with levels up to ten times background."

The new case-control study of the parents of 252 children with cancer was based on data collected in the New York Power Lines Project study of childhood cancer and power line EMFs (see *MWN*, N/D86 and J/A87).

Electric Blankets and Testicular Cancer

Electric blanket EMF exposure "contributes little, if at all," to higher risks of testicular cancer among adult white men, according to a paper appearing in the same issue of the *American Journal of Epidemiology* (pp.759-762).

A team of researchers led by Dr. Rene Verreault of the Fred Hutchinson Cancer Research Center in Seattle, WA, found a 40% increased risk of nonseminoma germ cell tumors—the finding was not statistically significant. They did not observe increases in seminoma. They did note that the risk of nonseminoma tumors increased somewhat with increasing duration of electric blanket use.

The team concluded that "chance remains a plausible explanation for the observation."

Call for Prospective Studies

In an editorial accompanying the Savitz and Verreault papers (pp.774-775), Dr. Richard Monson called for prospective epidemiological studies of EMFs that measure "current and future exposures in a precise and unbiased manner" and

"biologic outcome with precision, without error, and in a timely manner."

"I think there are enough scientific questions to warrant studies that collect data prospectively rather than retrospectively," Monson, of Harvard University's School of Public Health in Boston, MA, told *Microwave News*.

With respect to exposures from video display terminals (VDTs), Monson pointed out that, "Such studies are needed to assess the possible adverse effects of work with [VDTs] and pregnancy. It may seem unrealistic to attempt to assess prospectively the association between [VDT] use and specific birth defects, but is there any alternative?" He added that, "Prospective cohort studies that assess the association between occupational exposures to electromagnetic radiation and cancer may require thousands of study participants and decades of follow-up, but is there any alternative? Prospective cohort studies that assess prenatal and childhood exposure to electromagnetic radiation in relation to childhood cancer may indeed be unrealistic. The need in this context is to develop unbiased methods to assess past exposure."

Low Magnetic Field Electric Blankets Hit the U.S. Market

By the end of the year, at least two major U.S. electric blanket manufacturers will introduce low electromagnetic field (EMF) electric blankets.

Casco-Belton Corp. in Grover, NC, which markets its products under the brand name "Soft Heat," claims that its new wiring design reduces exposures from electric blankets to less than 1 mG. Northern Electric Co. in Chicago, IL, reports that the EMF exposures from its low field blankets and mattress pads—sold under the Sunbeam and Slumber Rest brand names—are reduced by 95%.

Citing the Food and Drug Administration's statement last year that there is no evidence that electric blankets are unsafe (see *MWN*, M/A89), Northern Electric President Ray Mehra said that, "The consensus in the scientific community is that there is no scientifically documented illness that is caused by the electric and/or magnetic fields." But he added that his company decided to "respond to what we anticipate may be a growing demand for low EMF appliances."

David Brantley, product manager at Casco-Belton, said that, "We were prompted by the fact that eventually this issue would become important."

Fears of liability rather than consumer pressures may have been responsible for the marketing move, according to one company spokesman. Indeed, Fieldcrest Cannon, the third major U.S. manufacturer, referred all EMF calls to its attorney, who refused to comment on the company's proposed low field bed products.

Brantley said that Casco-Belton's low field blanket will sell for approximately $18.00; the standard model retails for about $16.00. Brantley added that the company anticipates phasing out the standard version over the next 12-18 months. Northern Electric's low field blankets will cost 10% more than their standard models.

More on Sleeping with EMFs

• A prospective epidemiological study of fetal growth retardation and EMFs—from electrically heated beds, among other sources—is now under way at the Yale University School of Medicine in New Haven, CT (see *MWN*, J/A88). The $1.9 million study, which also covers miscarriages, includes direct measurements of EMF levels in the participants' homes. Yale's Dr. Michael Bracken, the principal investigator, told *Microwave News* that he expects results in 1993. The sponsors are the Electric Power Research Institute and the National Institutes of Health.

• Drs. Keith Florig and James Hoburg survey electric blanket magnetic fields in a paper appearing in the April 1990 *Health Physics (58, pp.493-502)*. Florig was, and Hoburg is, at Carnegie Mellon University in Pittsburgh, PA. Using computer models, they estimated that average exposures over the whole body range from 1.5 to 3.3 μT (15 to 33 mG), with a typical value of 2.2 μT (22 mG). In particular, they report that whole-body exposures for children are "significantly greater than those for adults." They point out that all U.S. blanket manufacturers recommend that children not use electric blankets, but they note that this warning is often ignored.

• Australians who use electric blankets may be exposed to significantly lower levels of ELF magnetic fields than electric blanket users in the U.S., according to Dr. Vincent Delpizzo of the Australian Radiation Laboratory in Victoria. He notes that Australians use electric *under*blankets, which operate at 240 V, between the mattress and the bottom sheet. These blankets expose users to average fields of approximately 2 mG, 1.5 mG or 0.5 mG (high, medium and low settings, respectively). U.S. electric blankets, which operate at 120 V and are designed to be used above the top sheet, expose users to average levels of about 5.6 mG. With regard to water beds, Delpizzo notes that they generate higher field levels, 4-5 mG, but only a small proportion of his study group reported using them. See *Radiation Protection in Australia, 7*, pp.67-69, 1989.

• The Electromagnetic Energy Policy Alliance (EEPA) has issued a fact sheet, "Automatic Electric Blankets—Comfort and Value Through Electromagnetic Energy." The four-page pamphlet points out that typical electric blanket magnetic fields are 3-50 mG, considerably below the IRPA ELF guideline of 1,000 mG, and that "the overall body exposure is similar to that generally prevailing throughout the home." It concludes: "...EEPA sees no reason to advise consumers to lose the well-established and valuable benefits which electric blankets provide."

• Some conflicting views on electric blankets were quoted in the *Boston Globe* (December 18, 1989): Dr. Robert Adair, a physicist at Yale University, stated that, "If you followed equal prudence about everything one did in life you'd stay in bed forever, or you'd starve to death because you could eat nothing." Dr. David Carpenter of the New York Department of Health said that he "absolutely" would not buy an electric blanket or let his child use one.

Congressional Moves for More EMF Research

Two new proposals introduced in Congress would provide funds for research on electromagnetic field (EMF) health effects at the Department of Energy (DOE) and the Environmental Protection Agency (EPA).

On May 10, Congressman Frank Pallone (D-NJ) introduced the "Electric and Magnetic Field Research and Public Information Dissemination Act of 1990," H.R.4801. Its key provisions are:

- The DOE would receive $34 million over five years for EMF research. The amount would increase each year, peaking at $10 million in fiscal year (FY) 1995.
- At least $1 million of the new funds would be spent each year on an EMF information center for public education.
- The DOE would investigate alternative electricity distribution systems designed to reduce EMF exposures.
- An advisory committee—made up of representatives of federal and state governments, utilities, public interest groups and academia—would review studies and recommend research priorities. The committee would issue an annual report.
- The DOE would consult with EPA and the National Institute of Environmental Health Sciences (NIEHS) in developing and implementing the EMF program.

Pallone also plans to introduce a separate bill in June that would establish exposure limits along transmission line right-of-ways (see *MWN*, M/A90).

On another front, Congressman George Brown (D-CA) is sponsoring an amendment to EPA's annual authorization bill that would allocate $5 million for EMF research—$1 million in FY91 and $2 million in FY92 and in FY93. Like the Pallone bill, the measure would require EPA to educate the public on EMF issues and work with the DOE and the NIEHS.

The amendment has been approved by the Committee on Science, Space and Technology and must now pass the full House. It must also win approval in the Senate.

DOE and EPRI EMF Reviews

The annual review of research on the bioeffects of ELF electromagnetic fields (EMFs) sponsored by the Department of Energy (DOE) will be held November 4-8 in Denver, CO. The Electric Power Research Institute (EPRI) will hold its annual utility seminar October 16-19 in Austin, TX.

For the first time in many years, EPRI will not be a sponsor of the DOE meeting (see *MWN*, N/D89). The American Public Power Association and the Edison Electric Institute will continue their support, however.

As in the past, the DOE meeting is open to the public and there is no registration fee. For more information, contact: W/L Associates, 120 W. Church St., Frederick, MD 21701, (301) 663-1915.

This year's EPRI seminar is titled "New EMF Epidemiologic Results & Their Implications." Registration fees range from $150.00 for EPRI members, government officials and university researchers to $1,000.00 for others. For more information, contact: Robert Banks Associates, Attn: EPRI Utility Seminar, PO Box 14574, Minneapolis, MN 55414, (612) 623-4646.

EPRI Sponsors $1.6 Million Mouse-Lymphoma Study

The Electric Power Research Institute (EPRI) has awarded Dr. Takashi Makinodan of the University of California, Los Angeles (UCLA), $1.6 million for a five-year study of lymphoma in mice chronically exposed to ELF magnetic fields. A pilot study is already under way.

The objective of the study is to determine whether magnetic fields are carcinogens, cocarcinogens or cancer promoters, Makinodan told *Microwave News*. Makinodan is a professor of medicine at UCLA and a co-director of geriatric research at the Los Angeles VA Medical Center. Ionizing radiation will be used as the initiator. The mice will be exposed to magnetic fields of less than 1 mG, 100 mG or 10 G, either alone or with low or high doses of gamma rays.

Similar efforts to develop an animal model of EMF carcinogenesis are under way in Sweden and in Canada (see *MWN*, M/J87 and J/A89).

Three States Plan Magnetic Field Mitigation Studies

Plans are under way in three states to study ways of reducing electromagnetic fields (EMFs) from high-voltage power lines.

In Washington state, the Department of Health (DOH) is leading a task force charged with investigating EMF mitigation techniques and their feasibility. The task force was mandated by a state law, enacted in March, which appropriated $40,000 for the two-year project; an earlier version of the bill called for a $100,000 budget.

The DOH has been designated by a second law (also passed in March) as the "state radiation control agency," responsible for collecting and disseminating information on non-ionizing radiation, particularly EMFs.

In Florida, the Environmental Regulatory Commission has appointed an independent EMF Task Force to lead a two-year, $1 million survey of magnetic field mitigation methods and costs. The seven-member task force, which began meet-

ing in January, has not yet decided how to spend the money, Jack Buford, the task force chairman, told *Microwave News*.

In April, Ken Klein, formerly of the Department of Energy and now a consultant, was hired as the project manager. Among the members of the task force is Sharon Rausch, one of three Boca Raton, FL, parents who filed suit to close a school near high-voltage power lines (see p.2). The project, which is being funded by the Florida Electric Power Coordinating Group, is an outgrowth of the state's magnetic field rules proceedings last year (see *MWN*, M/A89).

In New York, the Empire State Electric Energy Research Corporation (ESEERCO), a consortium of NY utilities, is soliciting proposals for methods of reducing power line magnetic fields. The successful bidder will characterize significant sources of EMFs and estimate the economic, environmental and social impacts of potential mitigation approaches.

In April 1988, the state Public Service Commission (PSC), following the recommendations of a staff task force, ordered NY utilities to survey power line magnetic fields and investigate ways of minimizing exposures (see *MWN*, M/A88 and M/J88). Utility representatives presented the survey results at a July 26, 1989 technical conference in Albany, NY (see *MWN*, M/A89 and J/A89). In April 1990, the PSC proposed an interim magnetic field standard of 200 mG for new high-voltage line right-of-ways (see *MWN*, M/A90).

The Electric Power Research Institute reported in 1988 that magnetic fields can be reduced by as much as 50% by changing the phasing of the lines (see *MWN*, J/F89).

Two New Low-Cost Meters

Two new inexpensive ELF magnetic field meters are now available. These complement the growing number of gaussmeters and dosimeters that have come on the market in the last two years. (For a complete list, see *MWN*, J/F90.)

Karl Riley of Magnetic Sciences International has developed MAG CHECK, a sensor which, he says, is similar to Electric Field Measurements' Model 116, designed by Dr. Don Deno. The unit, which costs $42.00, plugs into any digital multimeter with a 200 mV AC scale. Riley also offers a combined sensor-multimeter, the MSI-20, for $119.00. Both respond to magnetic fields from 0.1 mG to 200+ G in the 40-400 Hz frequency band. For more information, contact: Magnetic Sciences International, 2425 B Channing Way, Suite 489, Berkeley, CA 94704. Riley can be reached at RFD Box 312, Vineyard Haven, MA 02568, (508) 693-3188.

Widerange Instruments is marketing the MAGALERT model 660. The meter, which costs $84.50, is a small hand-held unit that gives readings from 0.1 to 100 mG. For more information, contact: George Work, Widerange Instruments, 110 Shelter Lagoon, Santa Cruz, CA 95060, (408) 423-1983.

HIGHLIGHTS

U.S. Army Performance on EMP Safety Faulted

An investigation by *Potomac News* into the U.S. Army's record on electromagnetic pulse (EMP) safety has uncovered a long history of ignoring federal environmental regulations and harassing those who pressed for compliance at the Army's Woodbridge Research Facility (WRF) in Virginia.

In a five-part series published in the April 9-13, 1990 *Potomac News*, a Prince William, VA, county newspaper, Gary Craig and Kevin Carmody describe how two Army environmental officials—Dr. Conner Gibson and John Ganz—were allegedly marked as whistle-blowers by the military, thus effectively destroying their careers.

From 1971 to 1988, the Army operated EMP simulators at the WRF, including the Army EMP Simulator Operations (AESOP) and the Repetitive EMP Simulator (REP). During this time, the Army planned to build a more powerful pulser—the Vertical EMP Simulator II (VEMPS II)—similar to the U.S. Navy's EMPRESS II (see box on p.7).

In documents obtained by *Potomac News* and made available to *Microwave News*, Craig and Carmody show how the Army neglected the EMP threat to health and safety and resisted reform:

- Three years after the Navy began work on an environmental impact statement (EIS) for EMPRESS II, the Army sought to avoid preparing a similar analysis for its proposed VEMPS II, because the pulser's operation would be "environmentally insignificant," according to a February 13, 1987 Army memo. This opinion came one month before the Washington, DC-based Foundation on Economic Trends (FET) sued the Department of Defense (DOD) to require environmental assessments for its EMP simulators (see *MWN*, M/A87). As part of a May 1988 agreement to settle the suit, the DOD shut down many of its EMP simulators—including those at Woodbridge (see *MWN*, M/J88).
- The belief that operating the WRF EMP simulators at full power caused no significant environmental impact was "consistent with 'gut' feelings," according to a June 1988 Army memo, which conceded that very little information was available. The Army expressed concern that operating at reduced

power "implies past operations [were] 'dangerous/reckless'." The Army also noted that the question of interference with "fly-by-wire" systems aboard aircraft was unresolved.

• The Army "continually stonewalled the issue of safety in fly-by-wire aircraft operations" (e.g., the Airbus 310 and the Boeing 757 and 767), John Ganz wrote in an April 14, 1989 letter to Senator Carl Levin (D-MI). Ganz claimed that the DOD blocked an FET subpoena because his testimony would be "most damaging" to the Army's case. Ganz said that he and Gibson, his supervisor, were branded as whistle-blowers and were held responsible for the closing down of the EMP programs. A federal investigation into these allegations is under way.

• Following the March 1989 airing of a CBS-TV *60 Minutes* segment on an EMP health effects lawsuit (see *MWN*, J/A88 and N/D88), Ganz lost his supervisory position. When he complained to the Army Inspector General, he was cross-examined about his loyalty to his country and given a polygraph test—which he passed. Gibson was dismissed by the Army in May 1989 and died of a heart attack shortly thereafter.

• Even while the EMP shutdown was in force, the Army sought to run a "free field" EMP test using a suitcase pulser at Fort Belvoir, VA. The proposed test was criticized by an attorney in the Army's Office of the Judge Advocate General in a November 3, 1988 memo: "On a statutory and regulatory basis, it is clear that free field EMP simulation requires an environmental assessment at a minimum. EMP testing is extremely controversial and reliable scientific data has yet to be established."

• The Army's claims to have complied with federal environmental rules were "a total vulgar fabrication," as well as "pathetic" and "totally indefensible," according to Gibson. Commenting on an Army public relations response to a May 10, 1988 *Washington Post* article on the FET's EMP lawsuit (see *MWN*, M/J88), Gibson said that, contrary to the Army's assertions, there were reports dating back to 1973 showing "serious documented concerns" with respect to the Army's compliance with environmental laws. In January 1989, the Army announced that it would prepare an EIS on EMP before resuming testing at Woodbridge. But six months later, the Army decided that it would no longer operate the simulators at Woodbridge and released an environmental assessment which did not address EMP (see *MWN*, J/F89 and J/A89).

• EMP testing at Woodbridge prompted community opposition—the WRF is located near residential neighborhoods and schools. In an August 1, 1989 letter to the Army, County Executive Robert Noe Jr. wrote that, "Prince William County officials have serious concerns over the human health and environmental impacts of the [EMP] testing that was conducted by the Army" and that the "Army has a responsibility to participate on a long-term basis in the evaluation of any human health impacts that may become evident in the future...." Craig reports that the Army is considering doing an epidemiological study of the WRF workers and that the Virginia Council on the Environment has suggested a similar study of Woodbridge residents.

In a response appearing in the May 11, 1990 *Potomac News*, an Army spokeswoman said that, "There were so many errors in fact in the articles that to attempt to correct them would result in another series of articles...."

A copy of the five-part series is available for $5.00 from: Barry Loftus, *Potomac News*, 14010 Smoketown Rd., Woodbridge, VA 22192, (703) 670-8151.

Navy Issues Draft EIS for EMPRESS II in Gulf of Mexico

The U.S. Navy has issued another draft environmental impact statement (DEIS) for its Electromagnetic Pulse Radiation Environment Simulator for Ships (EMPRESS II)—this one for operation in the Gulf of Mexico.

The Navy has evaluated four sites for EMPRESS II in this DEIS, each more than 25 miles offshore. The EMP simulator will be used in the gulf for approximately 60 days a year during the months of November through April (see *MWN*, J/A89). For the other six months, EMPRESS II is used in the Atlantic Ocean off the coast of North Carolina (see *MWN*, J/A88).

The Navy foresees electromagnetic interference to electronics as the only serious impact. To protect marine and aircraft electronics, the Navy will set up an air and surface exclusion zone with a height of 6,000 feet and a two-mile radius. With respect to human health, the Navy "will ensure that personnel aboard the ships under test will receive EMP intensities of no more than 50 kV/m."

This is the fourth EIS or DEIS the Navy has issued for EMPRESS II (see *MWN*, N84, J/F87 and M/J88).

Three public hearings on the DEIS were held in Alabama and Mississippi during the first week of May. For more information, contact: Lt. James Rose, Naval Sea Systems Command (PMS-423), Washington, DC 20362, (202) 746-1386.

USAF Seeks NAS-NRC Study on VLF Bioeffects from GWEN

The U.S. Air Force (USAF) has asked the National Research Council (NRC), an arm of the National Academy of Sciences, to review the potential health effects of very low frequency (VLF) radiation from the USAF's Ground Wave Emergency Network (GWEN). The move came in response to concerns expressed by Congressmen Lewis Payne (D-VA) and Les Aspin (D-WI).

The USAF's proposal is still "under review," Dr. Ray Cooper of the NRC's Board on Radiation Effects Research

told *Microwave News*. The final decision will be made by the Executive Committee of the NRC when it meets on June 13. If accepted, Cooper said that the report would take at least a year to complete.

The USAF's formal request came in a March 6 letter from Lt. Col. Stephen Martin, GWEN's program manager at the Electronic Systems Division at Hanscom Air Force Base, MA. Martin asked the NRC to answer a series of questions on GWEN radiation health risks, especially cancer.

In a telephone interview, Cooper cautioned that, "Some of the questions that the USAF wants answered may not be answerable with the present scientific data."

The GWEN communications system is designed to withstand the electromagnetic pulse (EMP) from a nuclear attack. When completed, it will consist of 96 relay towers across the continental U.S. operating at 150-175 kHz. The peak broadcast power for each GWEN tower is from 2-3 kW; it typically transmits six seconds per hour.

Payne's request for a review followed growing community opposition to plans to build a GWEN tower in his district. According to the *Washington Post* (December 27, 1989), a well-attended town meeting in Lovingston, VA, heard Dr. Stephen Cleary of the Medical College of Virginia in Richmond say that "there is enough information available in the literature [on health effects] to concern people."

For his part, Aspin, the chairman of the House Armed Services Committee, cited the need to update the USAF's final environmental impact statement on GWEN, issued in late 1987 (see *MWN*, N/D87).

Aside from concern over its potential health effects, there is also mounting opposition to GWEN from those who question its cost and utility at a time of reduced risk of nuclear attack. On February 27, Congressman Ron Machtley (R-RI) introduced H.R.4118, which would cut off funding for GWEN. Machtley's bill has gained the support of 13 cosponsors. Senator Claiborne Pell (D-RI) has introduced an identical bill, S.2257, in the Senate.

Nancy Foster, the director of the Amherst, MA-based GWEN Project, which opposes the program, told *Microwave News* that given the "dramatic changes in the world, GWEN should be a prime candidate for any list of Department of Defense budget cuts."

In an effort to defuse concerns about radiation, the USAF set a VLF radiation exposure standard of 50 V/m for publicly accessible areas around GWEN sites (see *MWN*, J/F86). The USAF's standard for its own personnel is 614 V/m.

Vote on Revision of 1982 ANSI RF/MW Safety Standard

Voting is in progress on the final draft of the proposed revision of the American National Standards Institute (ANSI) 1982 safety standard for human exposures to radiofrequency and microwave (RF/MW) radiation. Results of the subcommittee ballot are expected to be announced at a June 9 meeting in San Antonio, TX.

If approved, the proposed standard—designated ANSI C95.1-1990—will go before the IEEE's Committee SCC28 on Non-Ionizing Radiation Hazards for a vote.

In the previous vote, 50 subcommittee members approved the draft, 16 rejected it and 5 abstained. Most of those from federal health agencies voted against the draft. (For more on the proposed revision, see *MWN*, M/A89 and S/O89.)

Przemyslaw A. Czerski (1928-1990)

Dr. Przemyslaw Czerski died of cancer on Sunday, April 15, 1990 in Silver Spring, MD.

Born in Poland, Czerski earned his PhD and MD degrees at the Warsaw Medical Academy. In 1958 he joined the Military Institute of Aviation Medicine. Fifteen years later he became the chairman of the Department of Genetics at the National Research Institute of Mother and Child in Warsaw. In 1981, Czerski came to the United States to work at the Food and Drug Administration's (FDA) Center for Devices and Radiological Health in Rockville, MD.

Czerski's early research was on the hematologic and genetic effects of microwave radiation. He played an important role in setting up one of the first major symposia on microwave bioeffects in Warsaw in 1973. Together with Dr. Stanislaw Baranski, he wrote *Biological Effects of Microwaves* in 1976. At the FDA, he continued his research on the genetic effects of non-ionizing electromagnetic radiation (NIER) at both high and low frequencies. Czerski authored more than 150 publications.

Czerski is perhaps best known for his contributions to the international research community. He encouraged the World Health Organization to initiate NIER programs, first in Copenhagen, then in Geneva. These, in turn, led to the formation in 1977 of the International Non-Ionizing Radiation Committee (INIRC) within the International Radiation Protection Association (IRPA). Czerski was a founding member of INIRC and remained active on the committee until his death. In 1989, the FDA awarded him a commendation for his work.

Czerski is survived by his wife, Ewa, and their two daughters. Dr. Ewa Czerska continues to work at the FDA on NIER biological effects.

Over the years, Czerski made many contributions to *Microwave News*. We will miss him.

The decision on whether to apply EPA's risk assessment guidelines—originally developed for chemical carcinogens—to EMFs will now be made by two independent scientific review groups this summer.

Whatever the outcome, the EMF issue has gone from relative obscurity to national prominence. The question of how to deal with EMFs is now being debated at the highest levels of the Bush Administration and in the halls of Congress.

Regulatory strategies have not yet been formulated, but there is virtually unanimous agreement that a major federal research effort is needed to resolve the uncertainties associated with EMF health risks. It appears almost certain that EPA will resurrect its EMF research effort, which was shut down in 1986 (see *MWN*, S/O85).

A Meeting at the White House

In early 1990, after the OHEA staff made its recommendations and as its report neared completion, briefings were held for senior members of the EPA staff, including Deputy Administrator Henry Habicht II.

On March 6, a group of EPA officials briefed the White House Office of Policy Development. Among those attending the meeting were: Teresa Gorman, associate director of policy development for environment, energy and natural resources; Dr. James Wyngaarden, associate director for life sciences at the White House Office of Science and Technology Policy (OSTP); Richard Guimond, director of EPA's Office of Radiation Programs (ORP); and OHEA's Farland. Also present were representatives of EPA Administrator William Reilly, the Department of Energy (DOE), the Centers for Disease Control (CDC) and the National Cancer Institute (NCI).

Several sources characterized the meeting as an "information exchange." A staffer in Reilly's office told *Microwave News* that "it's not unusual" for EPA to advise the White House in memos or briefings about a significant issue. Gorman was unavailable for comment.

At a congressional hearing on power line health risks held by Rep. Peter Kostmayer (D-PA) just two days after the White House meeting, representatives from the DOE and EPA did not reveal that a major policy change was under discussion (see *MWN*, M/A90).

As late as March 12, the EPA evaluation recommended classifying ELF EMFs as "Class B1—probable human carcinogens." Within a week, the designation was deleted.

EMFs Pass the "Duck Test"

EPA insiders told *Microwave News* that the deletion of the B1 designation† for ELF EMFs was a compromise between the staff's recommendation and Farland's proposal to classify EMFs as "Class C—possible human carcinogens."

In a telephone interview, Farland explained that he personally deleted the B1 designation because "it was not appropriate at this time to classify EMFs as a carcinogen as we have classified other chemicals."

Farland said that he will ask two committees of experts—an external review panel and EPA's Scientific Advisory Board (SAB)—each to decide how to resolve the issue of risk classification.

Asked whether a chemical agent with the same carcinogenicity data as ELF EMFs would have been classified as B1, Farland replied: "I would still have some concerns classifying it as a probable human carcinogen if I really did not understand how it was working."

"The kind of information we have is enough for me to say that there is something going on and that the epidemiological data should not be dismissed," he said. "On the other hand, there is not enough to cause undue alarm. We need additional research."

Rep. Kostmayer urged EPA not to shy away from a cancer risk designation. In an April 25 letter to Reilly, Kostmayer wrote, "There can be no doubt that power line EMFs have passed the 'duck test': If it acts like a potential carcinogen, it must be addressed as a potential carcinogen." He stressed that, "The technical reasons given by EPA for not formally classifying power line EMFs as a 'potential carcinogen' may have merit, but for the purpose of protecting American citizens the distinction is moot."

Potential Carcinogens: EPA "Weight-of-Evidence" Classification and Hazard Ranking

Class A: Human Carcinogen	*Class B: Probable Human Carcinogen*		*Class C: Possible Human Carcinogen*
	B1: Limited Epidemiologic Evidence	*B2: Sufficient Animal Evidence*	
Arsenic (H)	Acrylonitrile (M)	Beryllium (M)	Methyl Chloride (L)
Asbestos (H)	Cadmium (M)	Carbon tetrachloride (M)	Saccharin (L)
Benzene (M)	Creosote (H)	DDT (M)	Trichloroethane (L)
Diethylstilbestrol (H)	Ethylene oxide (M)	PCBs (M)	
Vinyl chloride (H)	Formaldehyde (M)	Dioxin (H)	

Hazard Ranking: (H)=High; (M)=Medium; (L)=Low. Source: Office of Health and Environmental Assessment, EPA, June 1988.

The management of EMF risks will fall on EPA's ORP. Marty Halper, ORP's division director with responsibility for non-ionizing electromagnetic radiation (NIER), told *Microwave News* that EPA would not respond any differently whether the designation were A, B1 or C. Referring to siting battles over new power lines and radars across the U.S., he said, "The public is already extensively regulating EMFs: the net cost to society of EPA regulations may be less than what we are paying now."

Indeed, speaking at a conference in Cleveland, OH, at the end of April, ORP's Dr. Doreen Hill said that EPA is "swamped" with requests for EMF information from the public (see p.2).

"You can no longer say there are no biological effects due to ELF EMFs," Halper said. "But I can't say what the public health implications are. We're not talking about a radon in terms of potency, but we're also not talking about a zero effect."

RF/MW Radiation: A "Possible" Carcinogen

The OHEA report grew out of EPA's plan to issue rules for human exposures to RF/MW radiation (see *MWN*, J/A86). In 1986, EPA decided there was a need for an independent evaluation of the results of the long-term exposure study led by Dr. Bill Guy of the University of Washington, Seattle, which indicated an increase in cancer among rats chronically exposed to non-thermal doses of RF/MW radiation (see *MWN*, J/A84 and Mr85).

In the March 12 version of the OHEA report, the EPA staff recommended that RF/MW radiation be designated as a Class C carcinogen:

> For modulated non-thermal RF radiation, the human evidence is inadequate and the animal evidence is 'limited' based on the finding of a field-induced increase in the incidence of carcinomas of all sites in rats in an experiment that produced minimal tissue heating. Therefore, the evidence of carcinogenicity for non-thermal modulated RF radiation dictates a classification as a 'possible,' or Class C, carcinogen. In this case it is not called a carcinogen risk factor since the radiation treatment alone induced the effects without an additional factor in the experiment protocol.

This conclusion was also deleted from the review draft.

In an interview, ORP's Halper said that, "I am not ready to say we don't have concern outside the ELF area. We don't have the data." He emphasized that the document addresses all NIER. "We're being very careful to talk about NIER, not just ELF," he said.

* In 1986, EPA issued guidelines to assist in ranking suspected carcinogens in a consistent manner. There are five categories: "Human Carcinogens" (Group A), "Probable Human Carcinogens" (B), "Possible Human Carcinogens" (C), "Not Classifiable as to Human Carcinogenicity" (D) and "Evidence of Non-Carcinogenicity for Humans" (E).

† Chemicals which have been rated as probable human carcinogens on the basis of animal bioassays are designated as Subgroup B2. When the classification is based on human epidemiological studies—as in the case of ELF EMFs—a B1 designation is used.

EPRI CEO Goes to Washington To Talk EMFs

Dr. Richard Balzhiser, the president and chief executive officer (CEO) of the Electric Power Research Institute (EPRI), was in Washington at the end of May to talk to senior governmental officials about electromagnetic fields (EMFs).

On May 23, Balzhiser met with Dr. James Wyngaarden, associate director for life sciences at the White House Office of Science and Technology Policy (OSTP). Two days later, Balzhiser, accompanied by EPRI Vice President Dr. George Hidy, the director of the institute's environment division, met with EPA Administrator William Reilly and his staff. While in Washington, Balzhiser also spoke to officials at the National Academy of Sciences.

"Balzhiser wants to encourage as many agencies as possible to initiate work on EMFs on their own in order to have a broad scientific research program," EPRI's Barbara Klein told *Microwave News*. "We don't want to be the only players." Klein noted that Balzhiser and Hidy also had other energy-related issues on their agendas.

Dr. Robert McGaughy, project manager for the OHEA report, told *Microwave News* that the document "only addresses cancer and not central nervous system or reproductive effects."

Review Schedule

In an unprecedented move, Farland has decided to release a draft of the document to the public in June, before it is reviewed by EMF experts outside of the agency. "There is enough interest in the document to warrant its early release," he said. As a result, many federal agencies with responsibilities for EMFs will first see the document at the same time as the public.

In late May, EPA sent letters to potential reviewers seeking their participation: McGaughy said that he plans to assemble six to eight experts. This external review panel is scheduled to meet in Research Triangle Park, NC, at the end of June to discuss the draft document.

Following the March 6 White House meeting, the representatives from the DOE, NCI and CDC requested and received copies of the OHEA draft report. Each has already submitted comments to EPA. Informed sources told *Microwave News* that the NCI was critical of the EPA effort. The White House did not submit comments.

Sources said that the DOE distributed dozens of copies of the OHEA review to its staff and to its contractors.

After the external review is completed and the document is revised, it will go to the SAB Radiation Advisory Committee. Originally, EPA planned to make the draft public at that

time.

Whether the external review panel or the SAB will reinstate the B1 classification is not known. But the SAB is already firmly on record as favoring an EPA research program on EMFs.

In a May 4 letter to Administrator Reilly, Drs. Oddvar Nygaard and Raymond Loehr, the chairmen, respectively, of the SAB Radiation Advisory Committee and the SAB Executive Committee, argued that EPA should take an aggressive role in EMF policy. "The [SAB] continues to urge the agency to undertake a leadership role in this complex and important area," they wrote. "There is enough substance to the science in this area to require your attention." In 1988, the SAB wrote to then EPA Administrator Lee Thomas advising that the agency take an active role in NIER bioeffects research (see *MWN*, S/O88).

Specific plans for EMF research remain unclear. Farland told *Microwave News* that, "At this point there is an initiative in the several-million-dollar range," adding that most of the work would be done outside EPA. But other EPA officials said that no more than $2 million will be allocated for EMFs and new research may not begin until October 1991— that is, the 1992 fiscal year. They added that there continues to be resistance within EPA to resuming an in-house research effort.

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FROM THE FIELD

Summary and Conclusions of EPA's EMF Cancer Report

Reprinted below are the "Summary and Conclusions" of the Environmental Protection Agency's (EPA) draft report, An Evaluation of the Potential Carcinogenicity of Electromagnetic Fields (EMFs). *This summary, dated June 1990, will accompany the draft of the report which will be distributed to the external review panel, assembled by EPA.*

7.1. Introduction

In this chapter each of the major chapters in the document are summarized; a final section presents a discussion of the relationships among the individual chapters and the overall conclusions.

7.2. Mechanisms of Interaction Between Tissue and EMFs

The basic processes by which energy from EMFs of RF and ELF frequencies is coupled to the body are described in this section. The frequency dependence of the RF power absorbed by an organism is dominated by the body size, so that mice, rats and humans have different RF absorption characteristics. For ELF fields and the lower RF frequencies near the source, the relationship between the electric and magnetic fields is not fixed, as it is for RF fields, and they are evaluated separately in this document. From the point of view of EMFs, the body is composed of a solution of ions; it is an electrical conductor and the penetration of electric fields into the body is very poor at ELF frequencies. Since the body is composed of nonmagnetic materials, an external time-varying magnetic field permeates the body, inducing ionic currents.

The human evidence, as described in the next section, suggests that magnetic fields rather than electric fields are associated with cancer incidence, and mechanisms have been sought to explain how weak currents induced by ELF magnetic fields could interact with cells and body tissue in such a way as to induce a carcinogenic response. Three classes of models for this interaction are reviewed: (1) The surface compartment model deals with the movement of ions towards and away from the inner and outer surfaces of the plasma membrane of the cell, and deals with ion-selective membrane channels, ionic pumps and membrane ion fluxes. The model describes the movement of ions in response to perturbations of electric fields and magnetically induced currents around the cell. (2) The ion cyclotron resonance hypothesis was developed in part to explain the frequency sensitivity of calcium ion efflux studies of brain tissues. If the relationship among the frequency of time-varying magnetic field, the strength of a parallel static magnetic field and the ionic charge to mass ratio of an ionic species is correct, then the ion will resonate, or synchronously follow circular paths in a plane perpendicular to the field. In one experiment demonstrating this effect, conditions were set up for calcium cyclotron resonance, and the movement of bethnic diatoms was measured. The experiment showed that calcium ions entered into the cell under these specific conditions and stimulated the motion of the cells, whereas the cell is normally impermeable to calcium. This type of mechanism could be the basis of an induced selective ion permeability of the plasma membrane and might ultimately be capable of explaining both frequency selectivity of these effects and the sensitivity to small induced currents. (3) Another class of models deals with cooperative motions of an ordered array of lipid bilayer molecules and describes how a weak field affecting the motion of the whole array could be transferred to just one site in the array. These theories have not yet been tested in the context of ELF biological processes. At the present time, these basic models of tissue interaction with EMFs cannot be linked to the biochemical or cellular processes involved in the development of malignant growth.

7.3. Human Evidence

The effects of human exposure to EMFs from several sources have been reported. This document discusses ELF fields separately from higher frequency exposure where possible. Children with residential exposure are more appropriate subjects than adults for evaluating the effects of ELF fields, since children have relatively little exposure to higher frequency fields and occupational chemicals as a consequence of their normal activity patterns. Consequently, studies of childhood cancer associated with residential exposure to 60 Hz power frequency fields are discussed separately from occupational exposure to adults, which involves a mixture of both ELF and RF

fields.

7.3.1. ***Studies of Children:*** There have been six case-control studies of cancer in children examining residential exposure from power transmission and distribution systems and two additional studies examining childhood cancer in relationship to fathers' occupations. Five of the six residential exposure studies showed positive associations with ELF field exposure; three were statistically significant and the other two had odds ratios greater than one but not statistically significant. Where different cancer sites were evaluated, leukemia, nervous system cancer and, to a lesser extent, lymphoma were found to be in excess in the five residential studies showing positive associations. (Electric fields are not believed to be a critical factor.) The measure of magnetic field exposure was variable in the six studies. Wire code configurations and proximity to distribution lines were used for five of the six studies, and measurements were taken in two of the six studies. There is a good, but not perfect, correlation between measured magnetic fields and wire code configurations. In two of the studies in which magnetic field measurements were made, cases were observed in those exposed above 2-3 mG (0.2-0.3 μT) but not in people exposed below that level. Although one study found a significant dose-response relationship with respect to surrogate measures of exposure, reliable dose-response information is not available due to the use of dichotomized exposure categories and due to small numbers of cases within the exposure groupings. Issues pertaining to personal exposure and latency have not been addressed. The two paternal occupational studies found statistically significant associations between neuroblastoma and brain cancer, respectively, in children and their fathers' exposure to EMFs. There was also one report of a cluster of a rare tumor type (endodermal sinus tumors) in adolescent girls exposed to EMFs from power distribution lines....

The consistently repeated pattern of leukemia, nervous system cancer and lymphoma in the childhood studies and the ruling out of several confounding exposure factors in the Savitz et al. (1988) study argue in favor of a causal link between these tumor types in children and exposure to ELF magnetic or electric fields. However, the fact that the odds ratios are small and in many cases not statistically significant indicates that the association may not be strong and therefore argues against a causal relationship.

7.3.2. ***Studies of Adults***

7.3.2.1. *Residential Exposure to Power Frequency Fields:* In a total of four reports of cancer mortality or incidence in adults residing near electrical power distribution equipment, three were nonpositive and the fourth was clearly positive. In a case-control study of adult leukemia in Los Angeles, there was no association with electric blanket usage in the home. In contrast to childhood cancer, the adult studies were more difficult to interpret because they lacked the statistical power to detect a relative risk of the magnitude typically observed in the childhood studies and because there was little evidence that the cases were exposed to levels of EMFs higher than fields to which the controls were exposed. Therefore, no conclusions can be made about a cancer response and adult exposure to residential fields.

7.3.2.2. *Occupational Exposure to ELF and Mixed Frequency Fields:* Over 30 reports dealing with cancer incidence or mortality in workers in electrical and electronic occupations have been reviewed. These exposures have involved 50 or 60 Hz power frequency fields as well as mixtures of higher frequency fields which are typically poorly defined. The studies have been carried out in Europe, New Zealand and the United States. Many of them were re-examinations of previous studies or evaluations of vital records, cancer registry or occupational data bases, and thus the populations were not formed to test the specific hypothesis of whether EMF exposure is associated with increased cancer risk. Most of them used death certificates as a source of occupational information; this information furnishes only a very crude indicator of actual exposure to EMFs. Many of these are proportional mortality studies, which are less informative than studies of cohort and case-control designs because their results are affected by extraneous causes of death.

In these studies three types of cancer predominate: (1) hematopoietic system, especially leukemia and specifically acute myeloid leukemia; (2) nervous system cancer, including brain tumors; and (3) malignant melanoma of the skin. These cancer sites are found consistently across different geographic regions, age groups, industries, occupational classifications and study designs. Given this diversity of studies, in addition to the likelihood that across broad job categories the exposures to various chemicals is not uniform, it is difficult to identify any single agent or group of confounding exposures that could explain the consistent finding of these same cancer sites.

7.3.2.3. *RF Exposure:* Reports that focused primarily on exposures to RF radiation have shown mixed results, but most of the studies were difficult to interpret. Two early reports concerning microwave [MW] exposure of the U.S. embassy personnel in Moscow and radar exposure of U.S. Navy personnel showed only a slight tendency for increased cancer risk at all sites, and somewhat higher odds ratios for hematopoietic system cancers. A study of personnel in a World War II radar research and development laboratory found no convincing evidence of increased cancer incidence, but errors of exposure misclassification are likely. A series of reports of ham radio operators found a statistically elevated incidence of acute myeloid leukemia and other neoplasms of the lymphoid system, but no clear dose-response trend was seen with longer exposure, where the degree of exposure was inferred by FCC operator license class. One report of military exposure to radar found increasing rates of hematopoietic cancer of specific sites, but a lack of detail limits the ability to interpret the results.

7.3.3. ***Summary of Human Evidence:*** The strongest evidence that there is a causal relationship between certain forms of cancer, namely leukemia, cancer of the nervous system and, to a lesser extent, lymphoma, and exposure to magnetic fields comes from the childhood cancer studies. Several studies have consistently found modestly elevated risks (some statistically significant) of these three site-specific cancers in children. In two of the studies in which magnetic field measurements were made, cases were observed in those exposed above 2-3 mG (0.2-0.3 μT) but not in people exposed below that level. This is supported by the fact that children have relatively few confounding influences that could explain the association. In fact, the few potential confounders and biases that might have had an effect on the results were examined by one of the authors in some detail and found not to be a serious problem. No other agents have been identified to explain this association. However, there are contradictory results within these same studies, and dose-response relationships could not be substantiated. Furthermore, there is little information on personal exposure and length of residency in the EMFs.

Additional, but weaker evidence that there is an elevated risk of leukemia, cancer of the nervous system and perhaps other sites comes from occupational studies of EMF exposure. Although many of these studies have found an excess risk of these forms of cancer with employment in certain jobs that have a high potential for exposure to EMFs, few or no measurements have actually been taken in those occupations. Furthermore, information about occupation has come generally from sources that could be characterized as sketchy. The likelihood that misclassification or information bias is present in these studies is high. However, exposure misclassification, if random, tends to bias relative risks toward the null. Despite these weaknesses, the occupational studies tend to support the results of the

childhood studies, since the excess relative risks occur at the same sites.

The studies of residential adult exposures to EMFs provide little evidence of a risk of leukemia, mainly due to lack of statistical power and/or probably little exposure to levels of EMFs which have been found to be associated with cancer in children. These studies cannot be interpreted as evidence either for or against a causal association between cancer and EMF exposures. On the other hand, the case-control study of cancer in Colorado residents does support an association of central nervous system cancer and lymphoma if proximity to high-current electrical wiring configurations is assumed to be an adequate surrogate for exposure.

The studies of adults exposed to RF radiation produced mixed results, primarily because of limited sample size, inadequate length of follow-up, imprecise exposure data and lack of information on potential confounders. These problems prevent conclusions to be made about causal relationships with RF exposures. However, the statistically significant excess risks of leukemia in amateur radio operators require further examination.

7.4. Animal Carcinogenicity Evidence

7.4.1. ***ELF Fields:*** No lifetime animal carcinogen bioassay studies of ELF fields have been reported in the literature. Two studies currently in progress are designed to observe the induction of a carcinogenic response to chronic magnetic field exposures.

7.4.2. ***RF Radiation:*** Two chronic studies in mice have used unmodulated RF radiation at 800 MHz and 2450 MHz, respectively. Two studies in rats have used pulse modulated 2450 MHz of low power density and pulsed RF of all frequencies from 0 to about 20 MHz of high power density, respectively. One mouse study used pulsed RF radiation of 9270 MHz.

7.4.2.1. *Unmodulated RF Radiation:* For unmodulated RF radiation, one of the mouse studies (Szmigielski et al., 1982) shows that the radiation enhances the growth rate of spontaneous mammary tumors and in a separate experiment enhances the growth rate of skin tumors initiated by a chemical carcinogen, benzo(a)pyrene. In a shorter test (3 months), the same authors showed that the radiation also enhances the growth rate of transplanted lung carcinoma cells, an effect attributed to the lowering of cell-mediated immunity. Unfortunately, histopathology was not reported in the other mouse study (Spalding et al., 1971), so conclusions about carcinogenicity from that study are difficult to make.

The special nature of the response indicates that unmodulated RF radiation might be a promoter or cocarcinogen, since the growth rate of spontaneous breast tumors, BaP-induced skin tumors and transplanted lung sarcoma cells is enhanced by the radiation. There is a remote possibility that body heating could have contributed to this response, since the absorbed RF power is estimated to be at least one-half of the basal metabolic rate of the animals.

7.4.2.2. *Modulated RF Radiation:* For modulated RF radiation of relatively low power density [i.e., excluding the high power electromagnetic pulse (EMP) experiment of Baum et al. (1976)], the mouse experiment (Prausnitz and Susskind, 1962) showed a reversible pattern of lymphoma and leukemia which, in serial sacrifices, occurred toward the end of the 14-month exposure period but was not present in animals after a 5-month recovery period. However, the short 4.5-minute daily exposure was intense enough to raise the body core temperature by 3°C, raising the possibility that thermal effects were a contributing factor in the response. The rat study (Guy et al., 1985) showed the induction of benign adrenal medulla pheochromocytomas and a statistically significant increase in carcinomas of all organ and tissue sites. There was also a higher incidence of glandular organ carcinomas which was unaccompanied by an increase in the incidence of benign tumors of these sites. Although an increase of tumors of all types in the aggregate is regarded as only minimal evidence of carcinogenic action by chemical agents, the fact that the RF radiation affects all tissues in the body independently of their individual biochemical characteristics constitutes a reason to consider the aggregate count a relevant finding.

7.5. Supporting Evidence of Carcinogenicity

Section 5.11. presents a summary of the effects of EMFs on a variety of basic biological phenomena relevant in some way to mechanisms of carcinogenesis; that information is not repeated here. ELF fields of relatively high intensity (producing induced body currents on the order of 10 $\mu A/cm^2$) have enhanced DNA synthesis, altered the transcription of DNA into mRNA, altered the molecular weight distribution during protein synthesis, delayed the mitotic cell cycle, induced chromosome aberrations, blocked the action of parathyroid hormone at the site of its plasma membrane receptor, induced enzymes normally active during cell proliferation, inhibited differentiation and stimulated the growth of carcinoma cell lines, inhibited the cytotoxicity of T-lymphocytes (which indicates an impairment of the immune system) in vitro but not in vivo, inhibited the synthesis of melatonin (a hormone that suppresses the growth of several types of tumors), disrupted the morphology of neurons and glial cells in the central nervous system and caused alterations in the binding of calcium to brain tissues. The large variety of exposure conditions and the lack of detail on the geometry of the biological samples in these studies preclude a systematic evaluation of the actual induced currents and field strengths at the tissue and cellular level that are causing these effects. In addition, the lack of reproducible results between laboratories limits the interpretation of much of this literature.

RF fields modulated at the same ELF frequencies that cause some of the effects noted above also result in the same responses, indicating that the ELF component may be responsible for these effects. Unmodulated RF radiation has not caused any of the effects noted above except for chromosome aberrations. None of the EMFs have caused gene mutations, sister chromatid exchanges or DNA damage (as measured by DNA breaks, DNA repair or differential killing of repair defective organisms) in a large number of studies.

Only three ELF effects have been induced at field strengths comparable to the low environmental exposures at which human cancer has putatively been caused: (1) the calcium efflux from brain tissue preparations using 16 Hz crossed electric and magnetic fields; (2) calcium efflux from chick brain tissue after exposure of the developing embryo to electric fields; and (3) the inhibition of melatonin synthesis by the pineal gland when a static magnetic field of approximately the strength of the earth's magnetic field is changed through a small angle of rotation. The results of the first experiment are one of several phenomena that show a complex dependence on frequency, intensity and orientation with respect to the earth's magnetic fields.

In view of these laboratory studies, there is reason to believe that the findings of carcinogenicity in humans are biologically plausible. However, the explanation of which of the biological processes is involved and the way in which these processes causally relate to each other and to the induction of malignant tumors is not understood. Most of the effects have been observed at field strengths that are many times higher than the ambient fields which are the putative cause of the childhood cancers in residential situations; as a consequence, many of the candidate mechanisms may not be really involved in the response to low environmental fields. The same issue of low-dose extrapolation arises in the evaluation of chemical agents.

7.6. Integrated Discussion of Separate Chapters

The occurrence of cancer in humans exposed to low frequency

EMFs has been observed under several different conditions in different populations. Residential exposure of children, but not adults, has been associated with leukemia, lymphoma and brain cancer, and the same sites occur in multiple studies of children. The fields involved in these associations are magnetic and not electric fields, made up of primarily 60 Hz components but with inevitable high frequency components introduced by electric motors and the switching of currents on and off. In a few studies, these effects have been observed in children exposed to average magnetic fields above 2-3 mG (0.2-0.3 μT) but have not been seen in children exposed to smaller fields. The types of EMF exposures in the occupational studies are variable according to job category, with some jobs involving pulsed and modulated RF fields as well as 60 Hz power frequency components.

There is some, but not well-established, evidence that higher frequency components have different effects than 60 Hz components. Electrical switchyard workers exposed to spark discharges just before blood samples are taken have chromosome aberrations, whereas similar workers with no such exposure do not. Chromosome aberrations have been induced by unmodulated RF fields as well as by ELF fields. A recent preliminary report of an epidemiologic study of telephone workers shows a different effect (rare breast tumors in males) in people working in the "central office," where switching equipment is typically concentrated, than in cable splicers (leukemia) who presumably are exposed to predominantly 60 Hz power frequencies. Both electric and magnetic fields are more effective in inducing currents in the body if their frequency is higher, so that if induced currents are responsible for these effects, then the higher frequency components are expected to be more effective. If it is true that, as two studies indicate, the fathers' occupations in electrical jobs is a factor in the development of leukemia in their children, then the question is raised whether the effect could be transmitted via heritable genetic damage in sperm. This speculative hypothesis needs to be investigated.

Although there are several candidate EMF-induced biological phenomena...that could explain how a cancer response is caused in the whole organism by these fields, none of these or any combination of them has been verified experimentally, either in laboratory animals or in humans. Without understanding which combination of these is relevant to the carcinogenic process, it is not possible to hypothesize what aspect of EMF exposure is responsible for biological effects: i.e., frequency, average peak field strength, duration, time of day, whole-body average versus local critical site, electric versus magnetic fields, orientation with respect to the earth's static magnetic field. The choice of which aspect of the fields is the most relevant could be based on either knowledge of the correct mechanism of action or on empirical epidemiology correlations, but, given the current lack of information, neither method can serve as a basis for a dose-response analysis.

There are several indications that EMFs might contribute to the induction of cancer via indirect mechanisms, in contrast to a direct mutagenic action of DNA as is the case with nitrosamines, polycyclic aromatic hydrocarbons or other DNA-alkylating agents.

First, EMFs have not caused gene mutations in any of the large number of experiments carried out with both ELF and RF fields.

Second, there is no indication from the animal studies that RF fields cause a de-novo induction of tumors. On the contrary, the mice experiments by Szmigielski et al. (1982) indicate that unmodulated RF radiation acts as a growth stimulator for preexisting tumors. The same growth-stimulating or promotion characteristics of RF fields could explain the induction of glandular tumors in the Guy et al. (1985) lifetime rat study of modulated RF radiation, since many of the glandular tumors in that study had a naturally high spontaneous incidence.

A third factor indicating that there may be multiple causes of carcinogenic action is that 120 Hz-modulated 2450 MHz radiation can act as an initiator of phorbol ester-promoted cell transformation in mouse embryo cell cultures.

Finally, there are possible cancer induction mechanisms mediated by the central nervous system causing neuroendocrine influence on cellular proliferation. These mechanisms involve possible extremely sensitive detection of magnetic fields by the retina with resulting neural control of pineal melatonin activity, which in turn modulates estrogen and prolactin levels in the blood supply to the breast, prostate and other hormonally-sensitive tissues. Other speculative chains of events could be fabricated from the existing information in this document, and this one is mentioned here only as an example that there are many possible explanations but no verified ones.

In view of this, it is likely that if EMFs do contribute to the induction of cancer, the causal relationship will probably turn out to be dependent on many chemical factors and physiological conditions that are currently poorly understood.

There are two issues in the hazard evaluation of chemical carcinogens that are analogous to issues for EMFs. It may be helpful to explore whether the assumptions and conventions developed for chemicals are applicable to the EMF problem.

One analogy is that EMFs are mixtures consisting of several frequencies, intensities and combinations of electric and magnetic fields, which (for ELF frequencies) occur in arbitrary proportions. One approach to the assessment of chemical mixtures is to identify hazardous components of the mixture and, assuming additivity of components, consider the risk of the mixture to be proportional to the risk of the hazardous components. If this concept were applied to the EMF problem, then magnetic fields from 60 Hz power usage in the home would be the only "hazardous component" identified, although there is some indication that occupational exposures of adults to mixed fields may cause the same effect. Laboratory studies under relatively controlled conditions of exposure have not been able to test the additivity assumption for EMF components or for chemical components except for a few rare cases, but one feels more comfortable with the latter. With chemical agents, the basic phenomenon is ultimately some chemical reaction, which is expected to have additive properties at low enough concentrations, or at least to be monotonic in the sense that more chemical produces a greater effect. With EMFs, however, the ultimate causative interaction between fields and biological systems is unknown, and there is certainly no additivity with RF and ELF fields, or with ELF electric and ELF magnetic fields. The consequence of not being able to add the risks for different exposures is that the effects for each combination must be investigated and assessed separately.

Another analogy is the similarity between the "biologically effective dose" for chemical agents and the critical electrical measure of tissue "dose" which causes the effect for EMFs. For chemical agents the relationship between "administered dose" and "effective dose" has been studied occasionally, but only rarely. In the absence of this information, the default position for chemical agents has been to assume a linear relationship. Then there are hosts of unresolved questions in determining whether the biological effect is proportional to the "effective dose." These questions arise when, as is usually the case, the mechanism of action is not known. Here again the linearity assumption is made in the absence of knowledge, and the overall default position is that the adverse effect is proportional to the administered dose of the chemical agent. For EMFs, the "tissue doses" could be calculated, typically with great difficulty and uncertainty, but the same type of questions needs to be answered about which of these dose metrics are relevant for EMF exposure. As with

chemical agents, the choice of a candidate mechanism of action dictates which tissue dose metric is appropriate, and there could be several mechanisms for each of the administered agents. For EMFs, the default linearity assumption is not appropriate basically because there are frequency and intensity "windows" of activity for more than one EMF-induced biological effect and such "window" interactions cannot be ruled out as contributory to cancer causation.

In conclusion, the several studies showing leukemia, lymphoma and cancer of the nervous system in children exposed to magnetic fields from residential 60 Hz electrical power distribution systems, supported by similar findings in adults in several occupational studies also involving electrical power frequency exposures, show a consistent pattern of response that suggests, but does not prove, a causal link. Frequency components higher than 60 Hz cannot be ruled out as contributing factors. Evidence from a large number of biological test systems shows that these fields induce biological effects that are consistent with several possible mechanisms of carcinogenesis. However, none of these processes has been experimentally linked to the induction of tumors, either in animals or humans, by EMFs. The particular aspects of exposure to the EMFs that cause these events are not known.

In evaluating the potential for carcinogenicity of chemical agents, EPA has developed an approach that attempts to integrate all of the available information into a summary classification of the overall weight-of-evidence that the agent is carcinogenic in humans. At this time such a characterization regarding the link between cancer and exposure to EMFs is not appropriate because the basic nature of the interaction between EMFs and biological processes leading to cancer is not understood. For example, a real possibility exists that exposure to higher field strengths is actually less hazardous than exposure to low field strengths. Because of this uncertainty, it is inappropriate to make generalizations about the carcinogenicity of EMFs. As additional studies with more definitive exposure assessment become completed, a better understanding of the nature of the hazard will be gained. With our current understanding we can identify 60 Hz magnetic fields from power lines and perhaps other sources in the home as a possible, but not proven, cause of cancer in people. The absence of key information summarized above makes it difficult to make quantitative estimates of risk. Such quantitative estimates are necessary before judgments about the degree of safety or hazard of a given exposure can be made. This situation indicates the need to continue to evaluate the information from ongoing studies and to further evaluate the mechanisms of carcinogenic action and the characteristics of exposure that lead to these effects.

UPDATES

LITIGATION

FM Radio-Cancer Suit Settled...KYGO, an FM radio station near Denver, CO, has settled a lawsuit alleging radiation-induced cancer for an undisclosed sum. The suit, filed in August 1988 against station owner Jefferson-Pilot Broadcasting, Inc., charged that RF radiation had caused Beryl Main to develop non-Hodgkin's lymphoma and had exposed his wife to an increased risk of cancer (see *MWN*, S/O89). The agreement was reached in late March just as the case was about to go to trial. "I'm not permitted to disclose the terms of the settlement," Bruce DeBoskey, the Mains' attorney, told *Microwave News*. "I am totally unable to describe them." DeBoskey, of Silver & DeBoskey, is based in Denver. A 1986 survey by the EPA identified RF levels as high as 300 $\mu W/cm^2$ on the patio/deck of the square dance camp Beryl Main owned and operated with his wife near the KYGO broadcast tower—a hotspot of 10.35 mW/cm^2 was measured at the base of the tower (see *MWN*, M/A87). After the data were released, KYGO lowered its power output from 100 kW to 1 kW and agreed to limit radiation levels on camp property to 10 $\mu W/cm^2$ (see *MWN*, M/J87). The station later moved its antenna and transmitter.

OVENS

Salty to the Core... Salty foods cooked in a microwave oven may not heat evenly, two microbiologists at the U.K.'s Leeds University have concluded after doing a simple experiment with mashed potatoes. In a letter to *Nature* (April 5, 1990), Drs. Stephen Dealler and Richard Lacey describe how the higher the salt (or any other ionic compound) concentration in mashed potatoes, the lower their core temperatures after microwave cooking. They suggest that their finding may explain the recent increases in salmonellosis in the U.K., which is associated with eating incompletely cooked foods. Prepackaged microwave foods—which often have high sodium concentrations—might also be affected, they note. They suggest that the poor penetration of microwaves in saltier foods might be due to "the induction of electrical/ionic flow in the surface of food," and that this would also explain why "commercial food heated in microwaves commonly boils on the surface but is cool on the inside." (For more on incomplete cooking, see *MWN*, Ju81, A82, S/O88 and M/A89.)

PEOPLE

Dr. **Carl Durney** of the University of Utah, Salt Lake City, has been elected to membership in the National Council on Radiation Protection and Measurements (NCRP)....Dr. **Andrew Marino**, the editor of the *Journal of Bioelectricity*, has announced that Dr. **Ross Adey** of the VA Medical Center in Loma Linda, CA, and Dr. **Jocelyne Leal** of the Ramón y Cajal Hospital in Madrid, Spain, have become assistant editors of the journal. Dr. **Jerry Phillips**, who recently joined Adey's lab, is stepping down as an assistant editor....Dr. **Keith Florig** has left Carnegie Mellon University to join the Arms Control and Disarmament Agency in Washington, DC....Dr. **Sol Sax**, formerly chief physician at Ontario Hydro, is now director of occupational health for Boeing Canada's DeHavilland Division, based in Downsview, Ontario.

CLASSIFIEDS

News About *Microwave News*

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The first five years of *Microwave News* (1981-1985) will soon be available as a bound volume for $450.00. Look for the second volume (1986-1990) in early 1991. For more information, contact: Jennifer Goren at (212) 517-2800.

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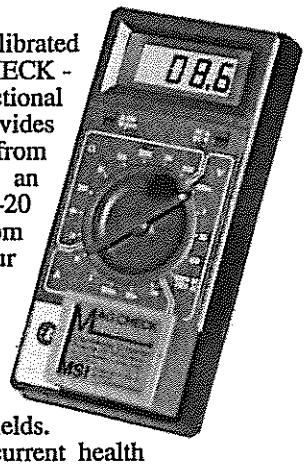
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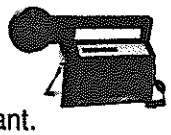
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MICRO WAVE NEWS

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EPA's SAB Panel Seeks To Downplay EMF–Cancer Link

Members of the Environmental Protection Agency (EPA) Science Advisory Board's (SAB) panel on electromagnetic fields (EMFs) plan to recommend a weakening of the agency's finding that EMFs are a "possible, but not proven, cause of cancer in humans" (see *MWN*, N/D90).

The panel, officially known as the SAB's Non-Ionizing Electric and Magnetic Fields Subcommittee, held its second meeting, April 12-13 in San Antonio, TX, to review EPA's draft report, *Evaluation of the Potential Carcinogenicity of Electromagnetic Fields.*

Many panel members argued that the executive summary of the EPA report assumes an increased cancer risk, which is not supported by the rest of the document, and that, in general, the report reveals a bias toward a positive association between EMFs and cancer. Dr. Bary Wilson spoke for many of his colleagues on the panel when he recommended that the report should be made "a lot less inflammatory." Interestingly, the formal classification of the cancer risk, a hotly debated issue when the draft was first released in June 1990, was hardly mentioned (see *MWN*, M/J90).

Some EPA staffers, however, left the meeting believing that the panel's recommendation to include recent studies showing an EMF–cancer link—particularly the one by Dr. John Peters of the University of Southern California in Los Angeles, and several on male breast cancer (see *MWN*, J/A90, J/F91 and M/A91)—would strengthen the report's conclusion of an in-

(continued on p.12)

Congressional Panel OKs EMF Funds, Cautions EPA on Cancer Report

The U.S. House of Representatives' Committee on Science, Space and Technology has authorized $2.2 million for electromagnetic field (EMF) research. In the process, the committee warned Environmental Protection Agency (EPA) Administrator William Reilly that the credibility of the agency's draft assessment of EMF–cancer risks is being threatened by White House "intervention" and by industry-related lobbying.

The committee's Subcommittee on Environment, chaired by Rep. James Scheuer (D-NY), is planning a hearing on EMFs for late July, according to a congressional aide. It was originally scheduled for June 25 but was postponed to allow staff more time for preparation. The agenda has not yet been set. Last year, the Scheuer subcommittee held a hearing on EMF funding legislation (see *MWN*, J/A90).

On May 22, the committee approved without significant opposition an amendment by Rep. George Brown (D-CA), the committee chairman, giving

(continued on p.14)

« Power Line Talk »

The number of cancer clusters anecdotally linked to EMFs continues to grow (see *MWN*, S/O90), with three new clusters reported in California and one in Pennsylvania. In **Fresno, CA**, school officials have agreed to close part of an elementary school within 110 feet of a 230 kV power line. "Even though we don't have conclusive evidence, we are going to move ahead," the school district administrator told *The Fresno Bee* (May 15). The decision came after teachers and parents protested, charging that ten teachers and aides who worked in the ten classrooms closest to the line developed cancer—two have died—during the past decade. In **Garden Grove, CA**, 11 of 65 Pacific Bell employees who worked in a basement office developed cancer, while there were no cases among the 75 workers on the next floor. The basement office is adjacent to a room in which electricity brought into the building is converted to run telephone systems (see also letter from Richard Tell on p.12). VDTs are also used in the basement. "I do believe these [EMFs] could very possibly have something to do with it," one worker told the Associated Press's (AP) Lee Siegel, who reported on the cluster in a three-part, widely-syndicated story starting on May 5. Pacific Bell officials told Siegel that they never thought to measure EMFs from the power room or from the VDTs. A union official has suggested several possible causes of the cluster, including automobile emissions from waiting cars lined up near a basement office window. In **San Jose, CA**, county health officials are planning to study five cancer cases—four of which have been fatal—in an office building near a power line, according to an AP report appearing in *The Los Angeles Times* (May 23). Previous investigations addressed the building's air and water quality. In **Scranton, PA**, residents suspect that four cases of cancer and fives cases of Hodgkin's disease within one neighborhood were caused by a nearby 69 kV power line. "It's very frightening and there's too much for it to be a coincidence," the mother of a 10-year-old with lymphoma told the *Sunday Independent* (January 13) of neighboring Wilkes-Barre, PA. At the residents' urging, U.S. Senator Arlen Specter (R-PA) has asked the Centers for Disease Control to investigate. Pennsylvania Power & Light, which owns the line, has agreed to work with local residents on a panel to consider how to resolve the controversy. Scranton Mayor Jim Connors brought the local concern to a national audience when he testified in January before EPA's Science Advisory Board panel evaluating the agency's EMF report (see *MWN*, J/F91 and p.1).

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Rumors that the **National Cancer Institute** (NCI) has banned its scientists from appearing as expert witnesses on EMFs have been confirmed (see *MWN*, J/F91). Dr. **Elliott Stonehill**, NCI's chief ethics officer, told *Microwave News* that the NCI now has a policy of denying requests from staff members to testify in EMF cases. In 1988, three NCI scientists—Drs. Stuart Aaronson, Lucius Sinks and Margaret Tucker—violated NCI limits on outside income by testifying for the New York Power Authority and were later reprimanded (see *MWN*, S/O88, N/D88, J/F89, S/O89 and J/F91). "We misjudged the political sensitivity of the situation," Stonehill said. In an interview with *The Scientist* (May 27), Stonehill said that, "At the time, we thought we knew what the scientific evidence said about the issue. But it later became clear that we didn't know the answers."

«« »»

Two new EMF mitigation research projects are under way. **Power Technologies**, Inc. (PTI), of Schenectady, NY, submitted the winning proposal to the **Florida Department of Environmental Regulation** (DER). The one-year contract is not yet final, but sources say it is likely to be for several hundred thousand dollars. According to Dr. Kenneth Klein of Energetics in Columbia, MD, who is managing the project for the DER, PTI will review current and proposed mitigation line designs—looking at both overhead and underground options—and evaluate their effectiveness in Florida's environment of high salt spray and frequent lightning. (Klein used to run the DOE's EMF program.) PTI will recommend two mitigation designs each for 230 kV and 500 kV lines. Funding for the study will come out of $1 million provided by the **Florida Electric Power Coordinating Group**, a utility lobbying association. PTI is an employee-owned company formed more than a decade ago by former GE workers. On a much smaller scale, on March 11, **EPA** hired **ICF**, Inc., a Fairfax, VA, consulting firm, to assess which consumer product manufacturers are taking steps to reduce EMFs. So far, only VDT makers and electric blanket companies are changing their products because of perceived consumer concerns about EMFs, reports an EPA staffer who declined to be identified. The limited findings have led EPA officials to question whether the informal survey should continue, he said. At most, EPA expects to spend about $25,000 on the effort....On September 10, **Washington state's** EMF task force will hold a one-day **symposium** in Seattle to address EMF mitigation techniques. The meeting is free and open to the public. By January 1992, the task force, as required under state law, must recommend to the legislature ways to reduce human exposures to EMFs (see *MWN*, M/J90). For more information, contact Patti Waller at (206) 586-7663.

«« »»

Congressional clout rests in committee chairmanships, and two new chairmen have EMFs on their agendas. Rep. **George Brown** (D-CA), who is now running the House Science, Space and Technology Committee, has shown a continuing interest in EMF health effects and recently sponsored an amendment allocating $2.2 million for EMF research. Brown's staff report-

edly has met with other members of the committee interested in EMFs, including Rep. **James Scheuer** (D-NY), whose Subcommittee on Environment is planning a hearing on EMFs for late July (see p.1). The resignation of Rep. **Morris Udall** (D-AZ) has put Rep. **George Miller** (D-CA) in charge of the House Interior and Insular Affairs Committee. In 1987, Miller held a hearing on the health effects of power lines, promising that, "We are not going to let the issue die" (see *MWN*, N/D87). Miller had scheduled a hearing for mid-January to investigate charges that the White House had interfered with the release of EPA's draft review report on EMFs and cancer (see *MWN*, N/D90 and J/F91); it was canceled because of the start of the Persian Gulf war. A Miller aide told *Microwave News* that EMFs "are on our agenda. It's an issue that we will continue to look into." Among the Interior Committee's members are Rep. **Peter Kostmayer** (D-PA), who held a hearing on EMF research last spring (see *MWN*, M/A90). What all this adds up to is a growing likelihood that EMFs will attract unprecedented attention in the 102nd Congress.

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With the Cambridge, MA-based **Health Effects Institute** (HEI) emerging as the leading candidate to coordinate a major public–private EMF research program (see *MWN*, M/A91), the institute is drawing scrutiny from all sides. Some who argue that federal funds should be kept separate from industry support are circulating an article that is critical of the HEI's public–private program on asbestos, Health Effects Institute-Asbestos Research (HEI-AR). In "The HEI-AR: Who is Affecting Whom?" (*Asbestos Issues*, January 1991), attorney **Edward Westbrook** of the Charleston, SC, law firm of Ness, Motley, Loadholt, Richardson & Poole questions the project's closed-door operations, the use of paid asbestos industry witnesses on HEI-AR's scientific review panel and the project's "resistance to any criticism, even constructive criticism." Westbrook concludes that HEI-AR should face congressional scrutiny if it refuses to change its ways. Dr. **Andrew Sivak**, HEI's executive director, shrugs off the charges. "I am confident that when the HEI-AR report is released, the unbiased nature of the panel and the fair and balanced content of the report will be apparent," he told *Microwave News*. On another front, a New Jersey EMF activist is starting a letter-writing campaign "to legislatures throughout the U.S. to stop [the HEI] from becoming a middleman in the EMF arena." In a letter to fellow activists, **Eileen Kotter** of the Center for Public Information on Electromagnetic Radiation in East Brunswick, NJ, wrote that, "Allocating DOE and EPA EMF research monies to an organization with no previous experience in this area has many people wondering who staged this event."

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The **HEI** will hold the first meeting of its feasibility study group June 11-12 at the Bostonian Hotel in Boston, MA. In early May, Dr. **Richard Setlow** of the Brookhaven National Labs in Upton, NY, agreed to serve as chairman of the project's feasibility study committee. Setlow is best known for his work on ionizing radiation, though he previously chaired a National Academy of Sciences–National Research Council panel on ELF effects (see *MWN*, M/A89). The other committee members are: NCI's Peter Blumberg; Charles Ehret of General Chronobionics, Inc.; Theodore Litovitz of the Catholic University; Martin Misakian of the NIST; William Moloney of Boston's Brigham & Women's Hospital; Richard Nuccitelli of the University of California, Davis; Russel Reiter of the University of Texas Health Science Center, San Antonio; Jeffrey Saffer of the Jackson Laboratory; David Savitz of the University of North Carolina, Chapel Hill; Asher Sheppard of the VA Hospital in Loma Linda, CA; Thomas Tenforde of Battelle Lab; and James Weaver of MIT. The HEI has also set up an Observers' Study Committee, which includes representatives from the CDC, DOE, EPA, EPRI, FDA's CDRH, NCI, NIEHS, NIOSH, Southwest Research Institute and the House of Representatives' Subcommittee on Environment. According to HEI's Sivak, a draft research plan should be completed by November. The HEI has closed the meeting to the press because, according to Sivak, participants should have a "candid, open discussion." Sivak also said that the institute still has not received funding from EPA, though he is confident that it will come through any day.

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The **FDA's CDRH** has set up a working group to coordinate the agency's work on ELF fields. According to the center's Dr. **Alan Anderson**, five different offices at the CDRH handle at least one aspect of ELF EMFs and the working group will "ensure coordination." Another CDRH staffer participating in the working group noted that its formation is an indication that the center is paying "a little more attention" to EMFs.

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Residents of **Beckton**, in east London, **U.K.**, are campaigning to remove a 400 kV overhead power line which they believe has caused increased rates of cancer and a case of mild epilepsy, as well as headaches, depression and lethargy. There is "a buildup of tension and fear" around EMF effects, the Beckton Residents Association's chairman, Gordon Marcham, told *The Independent*, a daily newspaper. He added, "Nobody will buy your house." **National Grid**, the British electricity distribution company, estimates that it would cost as much as £60 million ($102 million) to bury the line. The company insists that the link between EMFs and ill health is unfounded. But **Powerwatch**, a British watchdog group, calculates that EMF exposure from the power line is almost 150 times greater than the threshold level at which health is affected, based on epidemiological studies. Concern in England over the health effects of EMFs made headlines a year ago, when Great Yarmouth, a city on the coast of East Anglia, rejected a proposed overhead transmission line (see *MWN*, J/A90).

NIH Seeks Proposals for EMF Research

Citing widespread public exposures to extremely low frequency (ELF) electromagnetic fields (EMFs) and growing concerns about their possible hazards, the National Institutes of Health (NIH) is soliciting proposals for research on ELF EMF bioeffects. The request was issued "to encourage and foster investigator-initiated basic and applied research on the possible health effects of EMFs" from power lines and appliances, according to the program announcement.

The National Institute of Environmental Health Sciences (NIEHS), the National Institute of Neurological Disorders and Stroke (NINDS) and the National Institute of Child Health and Human Development (NICHD) published a joint request for EMF proposals from individual researchers (R01) and from young investigators (R29) in the May 17 *NIH Guide*.

"We are trying to solicit the scientific community to become more involved in this area," NIEHS's Dr. Michael Galvin told *Microwave News*. He stressed that, even though NIEHS closed down its internal research effort a few years ago, the institute is "very interested in receiving applications" (see *MWN*, J/A87).

Galvin's call for proposals was echoed by NINDS's Dr. Eugene Streicher. "There is a feeling that NIH is not sympathetic to EMF proposals, but that is not necessarily so. We are genuinely interested," he said in a telephone interview. However, Streicher noted that there is no money earmarked for EMF research and that applicants will have to compete with all those submitting proposals for all other research areas. He attributed the impetus for the NIH initiative to congressional interest.

"It's a good sign, but it would be even better if NIH set aside a pot of money exclusively for EMF research," Dr. George Harrison of the University of Maryland School of Medicine in Baltimore told *Microwave News*.

Some researchers are expressing concern that most of the review panels do not have expertise in EMFs and therefore may not be in a position to judge proposals adequately.

Nevertheless, there already are signs that the climate for EMF research at NIH is changing. NIEHS recently awarded a five-year, nearly $2 million grant to Drs. Ann Henderson of Hunter College and Reba Goodman of Columbia University, both in New York City, for a study titled, "Does Exposure of Human Cells to EMFs Cause Cancer?"

In addition, Dr. Stephen Cleary of Virginia Commonwealth University in Richmond has received an $834,000, four-year grant from NIEHS to study "Radiofrequency (RF) Radiation Cellular Mechanisms." Cleary told *Microwave News* that he will use the money "to determine the mechanism of RF-induced cell proliferation" (see *MWN*, M/A90).

In its May 17 announcement (PA-91-53), NIH called for basic research proposals which are designed to:

A. Determine the effects/mechanisms of action of EMFs on cellular responses such as DNA synthesis, modulation of ion binding and interaction with hormones and growth factors.
B. Determine the effects on cancer processes in vivo and in vitro.
C. Determine the effects of EMFs on reproductive/developmental and nervous systems in vivo and in vitro.
D. [Develop] well-characterized EMF exposure systems for assessing biological effects.

When asked to compare the NIH program to that of the Electric Power Research Institute and the one being developed by the Health Effects Institute, Galvin said that the NIH program will have a "broader focus," adding that, "We are going to let the scientific community determine the areas we address."

In late 1988, the National Cancer Institute (NCI) announced that it would sponsor an epidemiological study of the possible link between childhood cancer and EMFs (see *MWN*, J/F89). At that time, a number of NCI scientists dismissed EMF health risks as paid witnesses, later prompting NCI ethics officials to bar NCI staff from consulting on EMF issues (see p.2).

Last year, the National Toxicology Program, in which NIEHS is a participant, announced plans for a $6-10 million program for animal studies on the reproductive, developmental and carcinogenic effects of ELF EMFs (see *MWN*, S/O90).

Inquiries should be directed to: Dr. Michael Galvin, Program Administrator, Scientific Programs Branch, NIEHS, PO Box 12233, Research Triangle Park, NC 27709, (919) 541-7825; Dr. Eugene Streicher or Dr. Watson Alberts, Division of Fundamental Neurosciences, NINDS, Federal Building, Room 916, Bethesda, MD 20892, (301) 496-5745; and Dr. Felix de la Cruz, Chief, Mental Retardation and Developmental Disabilities Branch, NICHD, EPN, 631, Bethesda, MD 20892, (301) 496-1383.

Three States Consider Power Line Moratoriums

State legislators in Michigan, Rhode Island and Tennessee have introduced bills to ban power line construction temporarily. The proposed moratoriums are part of a flood of state and local actions to regulate EMF exposures (see opposite page).

The Rhode Island Senate and House of Representatives are expected to vote on moratorium legislation before the current session ends in June, while the Michigan and Tennessee proposals will probably not move out of committee, sources say.

Rhode Island Bills out of Committee

The Rhode Island legislation, introduced by Senator Michael Lenihan and Rep. Steve Hernandez, both Democrats, would impose a three-year ban on new power lines above 60 kV, to allow time for research efforts "to establish whether exposures to [EMFs] caused by electrical utility generating and transmission facilities present a risk to the health, safety and welfare of the citizens of Rhode Island." The legislation has been passed by the Senate and House Health, Education and Welfare Committees and is awaiting further action. "The fact that the evidence is inconclusive is enough to warrant a moratorium," Hernandez told *Microwave News*.

The Narragansett Electric Company, which will be forced

Other State and Local EMF Actions

Cities and states across the nation are moving to study, regulate and mitigate electromagnetic fields (EMFs), creating a flood of state and local legislation. At the same time, utility regulators are responding variously, funding research and requiring changes in transmission line designs, among other moves. Mohammad Harunuzzaman of the National Regulatory Research Institute (NRRI), writing in the *NRRI Quarterly Bulletin (12*, pp.47-56, March 1991), concludes that, "The public concern over health risks due to EMFs continues to grow and is likely to become one of the important environmental/public health issues of the nineties." Described below are a number of recent actions taken in response to the growing public concern over EMFs. (See also *MWN*, M/J89 and p.4.)

California...Senator Herschel Rosenthal's SB 920, introduced March 8, would require the Public Utilities Commission (PUC) to conduct a $4 million research and education program on EMF health effects, with up to $200,000 coming from the state and the balance to be paid by utilities. The research would determine whether EMF-exposed workers or children attending schools close to high voltage power lines are at risk. The bill would also direct state-owned utilities to develop mitigation techniques and programs to respond to customer EMF inquiries. The Senate Energy and Utilities Committee amended and approved the bill by a vote of 6-0 on April 23.

Colorado...On March 12, the Public Service Company (PSC) of Colorado announced that it will fund a $55,000 literature review on EMF health effects. Five experts from the University of Colorado, Colorado State University and the University of Denver will direct the independent analysis, according to PSC spokesman Mark Stutz.

Connecticut...Senate Majority Leader Cornelius O'Leary is sponsoring SB 633, which, as amended, would require public utilities to contribute $150,000 to an existing EMF task force for a literature review to set state EMF research priorities and to hire experts to develop a policy of prudent avoidance. The bill was reported out of committee and will now be considered by the full Senate.

Illinois...On April 12, Senator Arthur Berman introduced the Safe Power Transmission Act, SB 1436, which would require utilities to relocate any high voltage transmission line that is within 500 feet of an elementary or secondary school and which would set a 2 mG power line EMF limit for residential property. No action is expected this legislative session, according to a spokesman for Berman....On February 5, the town of Wilmette passed an ordinance limiting EMFs from a new Chicago Transit Authority substation to 2 mG at the edge of the property.

Maine...On February 20, Rep. Conrad Heeschan introduced LD 703, which would require EMF warning signs on all pad-mounted transformers and utility substations. The bill would also require the Department of Health and Human Services to survey ELF exposures in and around elementary schools and to report back to the legislature by March 1, 1992. The bill was approved by the House but has run into opposition in the Senate, according to a legislative aide.

Massachusetts...On March 25, six members of the House of Representatives announced the formation of the Legislative Task Force on Electromagnetic Radiation Hazards to study EMFs and to consider legislative initiatives....Several bills pertaining to EMFs were introduced into the legislature: Rep. Barbara Gardner's H 4331 would direct the Energy Facilities Siting Council to investigate EMF health effects, mitigation techniques and possible siting guidelines with up to $2 million from public utilities. Rep. Robert Koczera and Senator Robert Durand's H 2629 would "enhance public participation in energy planning decisions." Rep. Lida Harkins's H 3528 would empower the commissioner of the Department of Labor and Industry to establish video display terminal (VDT) EMF standards and would require employers of more than 25 people to offer pregnant women alternative work.

Missouri...On January 15, citing fears of EMF health effects on people and animals, the Linn Creek Board of Aldermen passed an ordinance prohibiting the construction of any 161 kV transmission lines, thereby blocking the construction of a 3.2-mile line, 700 feet of which would have passed through the town.

Oregon...Senator Grattan Kerans's SB 861 would require utilities to consider mitigation techniques when building high voltage power lines and would direct the Energy Facility Siting Council to set up a committee to monitor EMF research. The bill has been approved unanimously by the Senate. A companion bill, HB 3282, was proposed by Reps. Bill Dwyer and Lisa Naito. Naito also introduced HB 3363, which would require that the results of any study of EMF health effects by a state-funded organization be reported to the legislature. Rep. Thomas Mason's HB 3227 would require the Department of Human Resources to study the effects of EMFs from, among other sources, television, radio, cellular, microwave and satellite communications transmitters.

Washington...Six bills addressing concerns over power line siting and EMF health effects were introduced during the legislative session, which ended in April. Rep. Bill Grant's HB 1613 would have given jurisdiction over power line siting to the Energy Facility Site Evaluation Council. It also may have annulled the power line siting initiative approved by Whatcom County voters in November (see *MWN*, N/D90). Rep. Bruce Holland's HB 1547 would have prohibited increases in EMF levels from new or upgraded lines. Both bills, along with SB 5877, SB 5680, SB 5714 and HB 1198—all addressing EMFs—died in committee. Meanwhile, House Joint Memorial 4007, urging the President of the United States and the U.S. Congress to provide "additional funding to...resolve the growing concern about possible health effects from [EMFs]," was passed....In February, the Bonneville Power Administration (BPA) placed a two-year moratorium on approving new uses for transmission line right-of-ways (ROWs)—e.g., for playgrounds. In a press release, the BPA explained that, "The change is being made due to the controversy over whether exposure to EMFs from the operation of high voltage electrical equipment is a health hazard."

Pennsylvania PUC Ordered To Hold Hearing on 230 kV Line

Pennsylvania's top court has ordered the state's Public Utilities Commission (PUC) to hold a hearing within 90 days to consider the possible electromagnetic field (EMF) health effects of a 230 kV high voltage line that the PUC approved in February 1990.

On May 24, Judge Madaline Palladino ruled that the PUC should have considered the Philadelphia Electric Company's (PECO) application for the 12.8-mile Heaton–Woodbourne line as a request for a new use of an existing right-of-way (ROW) and not as an upgrade, as PECO had sought. Until 1986, Conrail operated a 138 kV line on the ROW to power its trains, according to a PECO spokesman. The utility began construction on the Heaton–Woodbourne line in the summer of 1990 and expects to complete work by this fall.

The PUC's review procedures for new lines are more thorough, and the siting requirements are more stringent, including a wider ROW. The Heaton–Woodbourne line, which would cross parts of Bucks and Montgomery Counties, north of Philadelphia, will have an ROW as narrow as 60 feet in some areas.

Parents Against an Unsafe Environment (PAUSE), the citizens' group that challenged the PUC's actions, wants the PUC to consider possible EMF health effects on people living near the ROW. Earlier this year, the PUC rejected, by a 3-2 vote, PAUSE's petition to reconsider its February 1990 decision and to hold a public hearing. In its ruling, the PUC majority concluded that the scientific evidence on EMFs is inconclusive and did not justify reopening the Heaton–Woodbourne docket. In May, the PUC rejected an appeal by PAUSE.

The PUC and PECO have not yet decided whether to appeal Judge Palladino's ruling.

to postpone plans for a new 115 kV line if the moratorium is adopted, "firmly believes that transmission lines are not a public health problem," according to Robert McCabe, the company president. "The legislation is an overreaction," he said in an April 9 letter to members of the Senate.

The moratorium, proposed in identical bills in the House and the Senate, is modeled after an East Greenwich, RI, town ordinance that was enacted in November (see *MWN*, N/D90 and J/F91). Following East Greenwich's lead, power line bans have been enacted in the towns of Coventry and Foster, and are being considered by the West Warwick and North Kingstown town councils. Rhode Island Superior Court Judge Patricia Hurst recently nullified the East Greenwich ordinance, ruling that the town council lacked jurisdiction over power line siting. Though the decision will be appealed to the state Supreme Court, the issue will be "moot" if the proposed statewide moratorium becomes law, Amato DeLuca, the town's attorney and the author of the ordinance, told *Microwave News*.

Michigan Ponders Study Committee

In Michigan, Republican Rep. Glenn Oxender has proposed a two-year ban on construction of power lines of 100 kV or more. The bill would prevent the construction of a $105 million, 115-mile, 345 kV transmission line from Battle Creek, MI, to Akron, IN, sought by the Consumers Power Company. "The government needs to get involved with this issue because people cannot handle it themselves," Oxender told *Microwave News*. While it is unlikely that the moratorium will be enacted this year, the state legislature will probably pass a resolution to set up a joint House–Senate committee to study power line EMF health effects and to issue recommendations to the legislature by December 31, 1992, according to Oxender.

At least eight towns and counties along the proposed Consumers Power line route have passed resolutions opposing the project, and Residents Against Giant Energy (RAGE) have asked the Federal Energy Regulatory Commission (FERC) to block the line, citing "dozens of scientific studies indicating that the emissions from high tension power lines...may be harmful to humans and livestock." Two U.S. congressmen from the state, Democrat Howard Wolpe and Republican Fred Upton, have voiced support for RAGE in letters to FERC.

Tennessee Town Sets 4 mG Limit

Companion bills, proposed by Tennessee Senator Keith Jordan and Reps. Beth Halteman and Clint Callicott, all Republicans, would ban the construction of high voltage power lines within one-half mile of any occupied dwelling or proposed subdivision. The bills would also require the state Department of Health and Environment to review EMF health effects data, conduct studies, if necessary, and report back to the Assembly by January 1, 1995. The bills were referred to a study committee and will probably not be passed this year.

On April 8, the town council of Brentwood, TN, passed the strictest power line EMF limit in the nation, prohibiting EMF "spillage" from power lines of 120 kV or greater from exceeding 4 mG at the edge of a right-of-way (ROW). The action came in response to Tennessee Valley Authority (TVA) plans to construct a 161 kV line alongside an existing 161 kV line that runs through the town.

The 4 mG limit was based on TVA estimates of EMF levels at the edge of the ROW if the new line were to be erected on the same set of poles as the existing line, Brentwood Mayor Joe Sweeney told *Microwave News*. The TVA, however, will continue with its plan to erect a new set of poles for the line, which it hopes will be operational by July, TVA spokesman Frank Cason said in a telephone interview.

"We'll have to wait and see what happens once the line is energized," Cason said when asked if the TVA will challenge the ordinance, adding that, "A lot of people down here think that it's unenforceable." New York State has an interim 200 mG edge-of-ROW magnetic field limit, while Florida has a 150-250 mG limit (see *MWN*, J/A90 and p.7).

Power Line EMFs Scrutinized in Australia

In Australia, two new surveys of electromagnetic field (EMF) health effects data have fueled controversies over power line siting and EMF exposures.

A research review commissioned by the New South Wales (NSW) government concluded that no firm EMF–cancer link has been established but advised caution with regard to public exposures, while a meta-analysis sponsored by the Victoria Health Department linked power frequency fields to a statistically significant increased risk of childhood cancer.

In February, former High Court Chief Justice Sir Harry Gibbs, director of the NSW *Inquiry into Community Needs and High Voltage Transmission Line Development*, released the survey results, concluding that, "It has not been established that electric fields or magnetic fields of power frequency are harmful to human health, but since there is some evidence that they may do harm, a policy of prudent avoidance is recommended." Gibbs also advocated "actively involv[ing] the community" in power line siting decisions.

In the course of his investigation, Gibbs contacted academics and community activists throughout Australia, reviewed a broad sampling of published studies and met with utility representatives and EMF researchers in Canada, Japan, the U.K. and the U.S. Though the investigation was originally intended to cover "the range of community concerns" about high voltage transmission lines, the 163-page report focuses principally on the EMF issue—of the 177 submissions considered by the investigators, 122 addressed EMF health effects.

The Victoria meta-analysis, released in December, identified a statistically significant doubling of the risk of cancer among children exposed to high levels of 50-60 Hz fields. The analysts, Ian Gordon, Milena Motika and Dr. Terry Nolan, were unable to arrive at any conclusions on residential or occupational EMF exposure and cancer in adults (see p.8).

Following the release of the meta-analysis, Maureen Lyster, Victoria's health minister, announced the formation of an independent panel to advise the government on power line EMF health risks. "This is an area in which much work is yet to be done before any conclusions can be drawn," Lyster said, adding that, "It is an issue that must be seen globally, not just locally."

Panel chairman Hedley Peach of Melbourne University, W.J. Bonwick of Monash University in Clayton and Roslyn Scanlan, a community health worker, will review relevant data both from Australia and overseas, consult with scientists and meet with local action groups and community organizations before issuing recommendations in late 1992. The group will also compile a pool of educational material and strive to promote a better public understanding of EMFs and possible health risks.

A spokesman for the State Electricity Commission of Victoria (SECV) denied a public health risk, stating that, "From our understanding, there is no association between exposure to magnetic fields and any health effects at any level," according to *The Age* (January 29), a Melbourne daily. On February 3, Melbourne's *Sunday Herald* reported that, after meeting with trade unions, the SECV softened its stance and was launching an investigation into the potential EMF health risks faced by its 18,000 workers.

The EMF health debate is not new in Australia. In 1989 Dr. Ken Joyner of Telecom Australia Research Laboratories in Clayton, Victoria, called for further research into the issue and recommended that "no group in the community should be exposed to environmental levels of ELF magnetic fields significantly in excess of those already experienced by other groups in the community." Also in 1989, Dr. Vincent Delpizzo of the Australian Radiation Laboratory in Yallambie, Victoria, published a critical review of literature on the subject, concluding that further investigation was warranted (see *MWN*, M/J89 and S/O89).

A number of Australian communities have organized against transmission lines. According to *The Advertiser* (June 2, 1990) of Adelaide, NSW, one public protest in West Australia resulted in a violent confrontation between demonstrators and police. Part of a transmission line scheduled to run from Brunswick to Richmond, in Victoria, was buried following a storm of community objections (see *MWN*, J/A86, S/O86 and J/F87).

Florida To Revisit ROW EMF Limits

The Florida Department of Environmental Regulation (DER) will reevaluate, but not necessarily revise, the state's electromagnetic field (EMF) exposure limits for new power lines as part of an agreement reached on March 25 with Hillsborough County. The limits, which were the first state right-of-way (ROW) levels ever adopted in the U.S., set maximum magnetic field exposure levels of 150-250 mG at the edge of ROWs.

In exchange, the county has withdrawn the legal challenge it initiated when the limits were issued in 1989 (see *MWN*, M/A89). In a December 1989 suit, county lawyers stated that the levels were "approximately 100 times greater than the intensity of magnetic fields, which are suspected to increase the incidence of all childhood cancer by 30 percent and to double the risk of contracting childhood leukemia" (see *MWN*, J/F90).

The reevaluation would, however, have occurred anyway under Florida law, leading an attorney for the department to call the agreement "a little less than a quid pro quo."

Buck Oven of the DER told *Microwave News* that the department will lower the exposure levels if it changes the limits at all. The DER's review will be closely watched by other states and localities that are weighing possible ROW limits (see pp.4-6). New York is the only other state with an ROW limit—an interim standard of 200 mG (see *MWN*, S/O90).

"I expect the DER's decision making will be rational, as it has been in the past," Carlos Alvarez said in a telephone interview. Alvarez, who works for the Tallahassee law firm of Hopping, Boyd, Green & Sams, is representing the Florida Electric Coordinating Group (FCG), a power utility lobby, in the Hills-

Annual DOE EMF Review

The Department of Energy's (DOE) annual review of research on the bioeffects of extremely low frequency (ELF) electromagnetic fields (EMFs) will be held November 3–7 in Milwaukee, WI. The meeting will be cosponsored again this year by the American Public Power Association and the Edison Electric Institute.

Objectives of the meeting are to review current research, identify areas requiring further study and encourage international coordination of research programs. As in the past, the meeting will be open to the public and there will be no registration fee. For further information, contact: W/L Associates, 120 West Church St., Frederick, MD 21701, (301) 663-1915.

borough case.

The attorney for Hillsborough County, Michael Skelton of the Tampa firm of de la Parte and Gilbert, declined to say whether he expects the limits to be lowered. However, he told *Microwave News* that, "There is a much more open mind at DER" than in the past.

Nancy Flemming, chairwoman of Concerned Citizens for Power Line Safety, which is based in Tampa (in Hillsborough County), said in a telephone interview that she is "encouraged because the DER is willing to work with us on this issue. We would rather work something out without litigation." But, she added, "If the DER does not come up with adequate safety standards, we will encourage the county to go back to court." Asked to define "adequate," she suggested a limit of 1.5 mG at the edge of ROWs.

The March 25 agreement is sealed and confidential, but a copy was obtained by *Microwave News*. It states that all of the parties agreed that their resources "would be more productively expended" in reviewing the DER rule than in litigation.

The department must complete its review by June 1, 1992, at which time Hillsborough County can reinstate its legal challenge if it is not satisfied with the outcome. Oven said the department will recommend a work plan to the state Environmental Regulation Commission in July. In addition to the DER and Hillsborough County, the agreement was signed by the Florida Power Corp. (FPC) and the FCG.

The DER's 1989 limits for new lines are 150 mG for lines carrying up to 230 kV, 200 mG for most 500 kV lines and 250 mG for certain double-circuit 500 kV lines, all applied at the edges of ROWs. For electric fields, there is a 2 kV/m limit at the edges of the ROWs at all three line loads and 8, 10 and 10 kV/m limits, respectively, for the three types of lines, *on* the ROWs.

There are separate limits for the 500 kV Lake Tarpon–Kathleen transmission line, part of which runs through Hillsborough County, as a result of negotiations between the state Siting Board and the FPC: daily maximums of 35 mG and 24 mG under normal load conditions where the ROWs are 100 feet and 190 feet, respectively. Levels as high as 229 mG at 100 feet and 154 mG at 190 feet are permitted for up to 15 hours per year.

The levels are controversial, partly because they are significantly higher than limits the DER had proposed a year earlier. In June 1988, the DER recommended daily *average* and *maximum* magnetic field levels of 50 mG and 100 mG, respectively (see *MWN*, M/J88). At the time of the release of the final standards, DER officials explained that the limits were based on engineering—not health—factors (see *MWN*, M/A89).

The 1989 limits resulted from a 1983 law directing the DER to develop public safety requirements for transmission lines following several siting disputes (see *MWN*, J/A83). In 1986, the Siting Board refused to approve the Lake Tarpon–Kathleen line, in part because the DER had not yet adopted EMF limits (see *MWN*, M/A86). That decision was overturned on appeal (see *MWN*, N/D87).

Hillsborough County first filed suit challenging the state limits in March 1989—charging that the levels were "not protective of public health" (see *MWN*, M/A89)—but temporarily withdrew the suit soon after. The suit was reinstated in December 1989. In mid-1990, the county sought and won a postponement of the scheduled administrative hearing to April 1, 1991.

Meta-Analyses Point to EMF–Health Effects Link

Dozens of individual studies point to an electromagnetic field (EMF) health risk, but others do not. Now, five teams of researchers have combined the data from similarly designed studies and have found that these meta-analyses do support a link between EMFs and adverse health effects.

An Australian meta-analysis of epidemiological studies, commissioned by the Victoria Health Department and directed by Dr. Terry Nolan of the Royal Children's Hospital in Melbourne and statisticians Ian Gordon and Milena Motika, both of Melbourne University, found that children exposed to fields as low as 3 mG were more than twice as likely as controls to develop cancer—a statistically significant increase. The researchers, who released a series of analyses in December, could not come to any conclusions for adult residential or occupational EMF exposures (see also p.7).

In a similiar effort, Edward Washburn and researchers at the Harvard School of Public Health in Boston, MA, along with colleagues from the Mount Sinai School of Medicine in New York City and from the University of Pennsylvania in Philadelphia, found that living near power lines was linked to higher risks of all the types of cancer that they examined, according to science writers Barbara Culliton and Robert Pool in the February 21 issue of *Nature*. The association was statistically significant in two cases—a doubling of the risk of central nervous system cancer and a 50% increase in the risk of lymphoma. The researchers also found increased risks for leukemia, childhood leukemia and childhood lymphoma. Washburn presented preliminary results on February 15 at the annual meeting of the American Association for the Advancement of Science (AAAS), in Washington, DC.

Dr. George Hutchison, retired from the Harvard School of

Public Health and now based in Louisville, KY, presented his own meta-analysis at the February Electric Power Research Institute (EPRI) epidemiology workshop in Carmel, CA. He concluded that evidence for a causal association between EMF exposure and cancer is generally weak (see p.13). Hutchison found a statistically significant EMF–cancer link in nearly every group he analyzed—including an overall 33% increased risk of leukemia for children with residential exposures and a 24% increased risk of central nervous system and brain cancers for adults with occupational exposures. Nevertheless, Hutchison downplayed these results, singling out a 144% increase in the risk of central nervous system cancer among children with residential EMF exposures as the only result which "points to a possible association." Hutchison's paper will appear in the proceedings of the Carmel workshop to be published by EPRI.

In a meta-analysis of laboratory studies, Dr. Kay Kimball "found some statistically significant changes in blood chemistry for small animals exposed to [extremely low frequency] ELF fields," she said in a telephone interview from her office at the Baylor College of Medicine in Houston, TX. Kimball, who also presented preliminary results of her work at the February AAAS meeting, combined data from 40 different experiments by six researchers. Of the seven effects she examined, she observed a statistically significant association between electric field exposure and decreases in total blood protein, as well as a "borderline" statistically significant association with eusenophil decreases.

Dr. Andrew Marino of the Louisiana State University Medical Center in Shreveport combined data from eight different multi-generational experiments conducted in the last 15 years and found that mice exposed to power frequency electric fields had a 30% chance of altered development. In a paper recently published in the *Journal of Bioelectricity* (*9*, pp.213-231, 1990), Marino also revealed that the exposed mice were 36% more likely to exhibit an increased variance in development—indicating that extremes in body weights, both high and low, were more likely in the exposed animals. (See *MWN*, M/A86 and N/D87.)

HIGHLIGHTS

U.S. Computer Makers Push for VDT EMF Limits

American computer manufacturers are leading a drive to establish U.S. and European computer industry guidelines for electromagnetic field (EMF) emissions from video display terminals (VDTs). The effort comes in response to consumer demand for low emission VDTs and a growing concern that unless the industry develops its own emissions guidelines, other, stricter limits may be widely adopted. Apple Computer, Digital Equipment Corp. (DEC) and IBM are the campaign leaders.

The computer industry is feeling pressure to write guidelines it finds acceptable because Sweden's VDT EMF limits specify electric field levels that the industry feels are too strict and because proposed New York City Board of Education purchasing guidelines for VDTs may be based on magnetic field levels that are even lower than the Swedish emissions limits. John Chubb, who in late April left IBM to join Apple in Cupertino, CA, said that the industry must realize that, "If we don't come up with something soon, we're going to pay the consequences."

In a telephone interview, Chubb said the Swedish guidelines are "becoming a de facto standard in the U.S." because they are "the only thing that customers can quote." The Swedish guidelines were developed by the National Board for Measurement and Testing, known as MPR—its name was recently changed to the Swedish Board for Technical Accreditation, or SWEDAC (see *MWN*, S/O88, M/J89 and S/O90). U.S. computer industry officials contend that the Swedish electric field levels are unachievable using current technology.

The move toward U.S. VDT guidelines is progressing despite a setback in March, when the Institute of Electrical and Electronics Engineers' (IEEE) P-1140 working group rejected EMF limits that specified the same magnetic field levels as MPR/SWEDAC but less stringent electric field limits (see *MWN*, M/A91). Those levels are now appended to the draft P-1140 measurement protocol for VDT extremely low frequency (ELF) and very low frequency (VLF) fields. Final IEEE action on the document is expected in mid-June.

The emissions limits may be taken up by another IEEE working group, according to Dheena Moongilan of AT&T in Holmdel, NJ, the chairman of P-1140.

At a May 9 meeting in Washington, DC, initiated by IBM and DEC, the Computer and Business Equipment Manufacturers Association, a Washington, DC, trade group, decided to poll its members on whether to endorse the P-1140 draft document. In addition, IBM has asked the European Computer Manufacturers Association (ECMA) to adopt the P-1140 limits. ECMA's Technical Committee 20 on Electromagnetic Compatibility, scheduled to meet by early June, has asked Chubb to submit a paper explaining the rationale for the guidelines.

The P-1140 protocol will be issued as either a one-year or two-year trial-use standard, which requires a less extensive IEEE review process than would a regular standard. In addition, a trial-use standard is easier to revise, according to P-1140 member Don Heirman of AT&T, also in Holmdel, NJ. The document is "on a fast track," he said.

The U.S. Food and Drug Administration (FDA) is watching to see whether the industry can agree on guidelines, according to Dr. Alan Anderson of the FDA's Center for Devices and Radiological Health in Rockville, MD. If it cannot, "then we will have to consider doing something," he said.

The P-1140 working group's draft guidelines for VDT emissions measurements call for magnetic flux density readings, not time-rate-of-change readings, as we reported in our last issue (see *MWN*, M/A91).

Over-the-Horizon Radars Almost off the Scope

U.S. Navy and Air Force proposals for a network of over-the-horizon (OTH) early warning radars have been curtailed in the face of diminished superpower tensions, budget constraints and local opposition. This spring, the Navy canceled its plan for an OTH radar in Wales, U.K., and the Pentagon announced that the only operational Air Force OTH system will run at reduced capacity.

The Navy originally intended to build 12 relocatable over-the-horizon radars (ROTHR). The project has been scaled back to four radars. One ROTHR became operational on Amchitka Island in the Aleutians in 1989. Another is to be based in Norfolk, VA, in September 1992. Two more were to be sited at St. Davids airfield in Wales and on the island of Guam in the South Pacific (see *MWN*, M/A88), though they will now be put in storage in Wales and on Guam due to local opposition. Welsh-Americans were particularly active in lobbying Congress against the program. Raytheon in Lexington, MA, is the prime contractor for the ROTHR system. (In August 1989, the Navy issued *A Study of Electromagnetic Environmental Effects Associated with the [ROTHR].*)

During the late 1980s, the Air Force built over-the-horizon backscatter (OTH-B) radars near Moscow, ME, and Christmas Valley, OR, and was planning to build two more in Alaska and North Dakota (see *MWN*, J/F86, M/A86 and M/A88). Earlier this year, the Air Force said that it would mothball the Maine and Oregon OTH-Bs and cancel construction of the Alaska and North Dakota radars because of budget cutbacks and "a change in the perceived threat," according to an Air Force spokesman.

The Air Force has now decided to keep the Maine radar open forty hours a week, after appeals from Senators George Mitchell (D-ME) and William Cohen (R-ME), according to a report in the May 28 *New York Times*. The OTH-Bs were manufactured by General Electric of Syracuse, NY, and cost more than $1 billion to develop.

OTH radars bounce signals off the ionosphere to provide an effective range of up to 2,000 miles—reportedly almost ten times farther than conventional ground-based radars.

BENER Is Back

Information Ventures will publish an update of *Biological Effects of Non-Ionizing Electromagnetic Radiation* (BENER), a quarterly abstracting service. The first issue of the *BENER Digest Update* will appear in June and will include abstracts of 106 papers and 258 conference presentations.

Information Ventures suspended publication of the digest in September 1989 when the Office of Naval Research (ONR) cut funding for its electromagnetic radiation program (see *MWN*, N/D89). Under ONR sponsorship, the BENER digest was distributed at no charge to 650 readers around the world.

The *BENER Digest Update* will cost $75.00 and will cover papers released since 1989. Other issues will follow if there is sufficient demand, Dr. Robert Goldberg of Information Ventures told *Microwave News*.

Goldberg said that Information Ventures is also now marketing a computerized BENER literature database with more than 8,600 abstracts on IBM-compatible computer diskettes. The data base, which covers the complete 13-year BENER digest abstracts, some additional abstracts and the new update abstracts, is available for $3,500.00.

Contact: Information Ventures, Inc., 1500 Locust St., Suite 3216, Philadelphia, PA 19102, (215) 732-9083.

ELF and RF/MW Measurement Notes

Residential Surveys

Because power frequency electromagnetic fields (EMFs) inside homes can be far weaker and considerably more complex than those near power lines, the American National Standards Institute (ANSI) 1987 standard for measuring power frequency fields may be inappropriate for residential environments. The standard "has certain shortcomings if used alone as a guide for characterizing residential magnetic fields," according to a task force of the Institute of Electrical and Electronics Engineers' (IEEE) Power Engineering Society (PES).

In a paper in the *IEEE Transactions on Power Delivery, 6*, pp.901-911, April 1991, the PES's Magnetic Fields Task Force reported that in-home field levels can be two orders of magnitude lower than those near power lines and can "contain large percentages of harmonics, e.g., in excess of 30%." The task force found that small, personal exposure meters give "more realistic exposure estimates" for individuals than do fixed-location units.

In general, the task force recommended case-by-case strategies for making residential surveys. "The number and types of measurements will increase as the measurement goals become more comprehensive," it reported. The paper's principal authors are Dr. Martin Misakian of the National Institute of Standards and Technology in Boulder, CO, Michael Silva of Enertech Consultants in Campbell, CA, and Rod Baishiki of Pacific Gas & Electric in San Francisco, CA.

The PES Magnetic Fields Task Force is an offshoot of the AC Fields Working Group of the Corona and Field Effects Subcommittee of the Transmission and Distribution Committee. The 1987 standard referred to by the task force is *ANSI/IEEE Standard 644-1987, IEEE Standard Procedures for Measurement of Power Frequency Electric and Magnetic Fields from AC Power Lines.*

EPRI Dosimetry Workshop

Many of the leading EMF measurement specialists from Canada, Sweden, the U.S. and the U.S.S.R. participated in a four-day dosimetry workshop in Carmel, CA, in March. The workshop, which was sponsored by the Electric Power Research Institute (EPRI), included 22 presentations on macroscopic and microscopic dosimetry, background fields and signal-to-noise issues and extrapolations across biological systems. The event concluded with a panel discussion on research needs led by Dr. Bill Guy of the University of Washington in Seattle; panelists included Dr. William Kaune of Enertech Consul-

tants in Campbell, CA, Dr. Charles Polk of the University of Rhode Island in Kingston, Dr. Thomas Tenforde of Battelle Lab in Richland, WA, EPRI's Dr. Howard Wachtel and Dr. James Weaver of MIT in Cambridge, MA. The proceedings will be published in an upcoming issue of *Bioelectromagnetics*, according to Dr. Richard Phillips of W/L Associates in Spokane, WA, who organized the workshop.

Low-Cost ELF Meters

The growing demand for low-cost extremely low frequency (ELF) magnetic field meters is being met by a surge in new products. There are now 33 ELF meters on the market costing less than $1,000. Here are the latest entrants in this increasingly competitive market:

• F.W. Bell has introduced the model 4060 for 60 Hz measurements from 1 mG to 5 G. It sells for $179.00. To locate the nearest distributor, call the company's "ELF Hotline": (407) 678-7308; or contact: F.W. Bell, Inc., 6120 Hanging Moss Rd., Orlando, FL 32807.

• Holaday Industries has introduced two ELF magnetic field meters. The HI-3624 can measure fields from 0.2 to 20 mG in the frequency range of 30 Hz to 2 kHz. It costs $389.00. A modified version, the HI-3624A, is sensitive down to 5 Hz, and can therefore be used in accordance with the Swedish video display terminal (VDT) guidelines. It costs $459.00. Holaday already sells two high-end magnetic field meters: The HI-3603 ($1,095.00) can measure very low frequency (VLF) magnetic and electric fields, and the HI-3604 ($1,195.00) can measure ELF magnetic and electric fields; they were previously sold as the HI-3600-01 and the HI-3600-02, respectively. For more information, contact: Dave Baron, Holaday Industries, Inc., 14825 Martin Dr., Eden Prairie, MN 55344, (612) 934-4920.

• Memtec Corp. is offering the ELF-DETEC, with a frequency response from 50 Hz to 1 kHz for measurements from 0.22 mG to 50 mG. It is available for $49.95 from: Memtec Corp., Keewaydin Dr., Salem, NH 03079, (603) 893-8080.

• Teslatronics of Alachua, FL, is marketing the ELF Alert, a magnetic field meter for the 30–300 Hz frequency range and for fields of 1 mG to 2 G. It costs $99.95. For more information, contact: Michael Koch, Teslatronics, Inc., One Progress Blvd., #25, Alachua, FL 32615, (904) 462-2010.

New RF/MW Meters

• Several new radiofrequency/microwave (RF/MW) meters are now available from Loral Microwave-Narda. The Model 8840B Nardalert Personal Monitor can check RF/MW exposures in the 2–18 GHz range. It provides continuous readings for workers in potentially hazardous areas where high-power radar, communication or electronic warfare systems are in use. The meter can be purchased with a factory-set sensitivity threshold of either 1 mW/cm^2 or 5 mW/cm^2. Narda has also introduced the SMARTS area monitor to measure 0.5-18 GHz microwaves with a factory-set sensitivity threshold of 1 mW/cm^2. The Nardalert is available for $695.00 plus shipping, and the SMARTS costs $2,495.00 plus shipping. Contact: Loral Microwave-Narda, 435 Moreland Rd., Hauppauge, NY 11788, (516) 231-1700.

• Holaday has introduced a new broadband RF/MW meter to take readings at the proposed ANSI C95.1 levels. The HI-3012, which is intended to replace Holaday's HI-3002 meter, has both electric field and magnetic field probes with sensitivity from below 0.05 mW/cm^2 (10 V/m and 0.03 A/m) to above 250 mW/cm^2. It can be used at 500 kHz-6 GHz for electric fields and at 5–300 MHz for magnetic fields. The HI-3012 costs $4,395.00 plus shipping (see above for contact information).

• The EMI-Control Center of the Asea Brown Boveri in Baden-Dättwil, Switzerland, has developed a meter for measurements from 75 kHz to 30 MHz. It uses a single probe to take simultaneous electric and magnetic field readings. For more information, contact: Asea Brown Boveri AG, EMI-Control Center, CH-5404, Baden-Dättwil, Switzerland, (41+056) 76 83 07.

Microwave News has updated its list of available gaussmeters published last year (see *MWN*, J/F90). For a copy of the current list, send a self-addressed, stamped envelope and $1.00 (U.S.) to: *Microwave News*, PO Box 1799, Grand Central Station, New York, NY 10163.

EMF Testers Group

Eleven EMF measurement specialists have banded together to create the National Electromagnetic Field Testing Association (NEFTA), representing independent non-ionizing radiation testing firms. Founding members are: John Banta and David Bierman of SafeEnvironments in Berkeley, CA; Dr. Robert Becker, author of *Cross Currents* and many other books and articles on EMFs; Dr. David Brodeur, who operates a testing firm in Manchester, MA, and whose brother, Paul, has written extensively on EMFs; Dr. William Lee of Alphalab in Salt Lake City, UT; Ralph Pinto of Healthy Habitats in Sedona, AZ; Ward Rapp and Patricia Clark of Environmental Management and Field Testing in Evanston, IL; Joseph and Leah Riley of Healthwaves in West Orange, NJ; and Peter Sierck of Environmental Testing & Technology in Encinitas, CA. Rapp told *Microwave News* that the group represents companies testing at all non-ionizing radiation frequencies, although most of the work currently is done at ELF. For more information, contact: Ward Rapp, NEFTA, 628-B Library Pl., Evanston, IL 60201, (708) 475-3696.

Measurement Resources

• Two meter companies are also providing resource publications. Magnetic Sciences International (MSI) in Berkeley, CA, has updated its *Magnetic Field Guide*, a 51-page handbook published to accompany its MSI magnetic field meters. Following a short section on operating instructions, the handbook covers basic magnetic field information, suggestions for in-home and on-the-job measurement protocols, prudent avoidance tips and other topics. It is available for $12.50 from: Karl Riley, MSI, Box 489, 2425B Channing Way, Berkeley, CA 94704, (415) 486-1024.

• Electric Field Measurements (EFM) in West Stockbridge, MA, has started publishing the *EFM Newsletter*. Each issue includes information on technical applications, a list of current products and other information for EMF measurement specialists. A one-year subscription in the U.S. costs $20.00. For more information, contact: Don Deno, EFM, Route 183, West Stockbridge, MA 01266, (413) 637-1929.

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FROM THE FIELD

Magnetic Field Exposures Among Office Workers

To the Editor:

I would like to call your readers' attention to a common source of exposure to 60 Hz magnetic fields which may not be apparent to others. During several years of measurements, I have found that people in commercial office buildings who work near conductors carrying high currents may be exposed to strong magnetic fields. Ironically, those individuals who work in the strongest magnetic fields may be those who know nothing about their potential for exposure.

In the course of my investigations, I have found people working in offices where large power conductors cross the floors, walls and ceilings. These conductors are associated with the distribution of electrical service to various parts of a building from the primary electrical switchgear room. They are commonly present in large commercial buildings and may carry thousands of amperes of 60 Hz current.

Depending on the layout of the wiring and whether it consists of cables or bus bars, the ambient magnetic fields in offices may be as high as 3,000 mG. For example, I have measured flux densities in the range of 400 to 900 mG throughout the entire accessible area of some offices and up to 3,000 mG within 30 cm of concealed power conductors. Electrical conductors, then, can be responsible for very high whole-body magnetic field exposures among office workers without their knowledge.

According to the most comprehensive study of occupational exposures to 60 Hz magnetic fields, conducted by Dr. Dan Bracken for the Electric Power Research Institute (EPRI), electrical workers who are primarily employed in power distribution have the greatest exposures.* For example, EPRI found that only 5% of electrical distribution workers had average workday magnetic field exposures greater than 42 mG. The greatest median workday exposures were among substation workers and were, on average, only 7 mG. The distribution workers had a median workday average exposure of just 2 mG.

My measurements and Bracken's assessments suggest that some office employees may be more highly exposed than electrical workers —even though the areas of highest magnetic fields in commercial buildings are generally small and those affected may only be a fraction of the total work force. Mobility of office workers will of course affect magnetic field exposures, but the limited mobility of some workers may keep them in the areas with the highest fields. For example, an office worker remaining eight hours in an office with a general, ambient flux density of 400 mG would have a workday mean exposure of 400 mG.

If the magnitude of magnetic field exposures is related to biological effects, these observations suggest that epidemiological studies of office workers may be of greater interest than studies of electrical utility workers. I have found that one can very easily identify those areas within commercial buildings where magnetic fields are greatest simply by reviewing architectural plans.

It is possible that, while our initial interest in electrical worker exposures was logical, we may have been searching only near the proverbial streetlight because that is where the light is.

Sincerely,
Richard Tell, President
Richard Tell Associates, Inc.
6141 West Racel St., Las Vegas, NV 89131

* T. Dan Bracken, Inc., *The EMDEX Project: Technology Transfer and Occupational Measurements*, Volumes 1-3. EPRI Report No. EN-7048, Palo Alto, CA: EPRI, November 1990.

SAB Panel on EMFs *(continued from p.1)*

creased cancer risk, according to *Inside EPA* (April 26), a Washington newsletter, which does not disclose its sources.

By the end of the meeting, the panelists were optimistic about reaching a consensus. "It sounds like there's the making of a document that we all can agree on," said Dr. Granger Morgan. The SAB's Kathleen Conway noted that the panelists were "more in agreement on issues than I had anticipated at this point."

The future of the EPA report was thrown into doubt, however, when Dr. Genevieve Matanoski, the chair of the SAB panel, revealed near the close of the meeting that there was intense opposition to the report from some members of the panel's parent committee, the SAB's Radiation Advisory Committee (RAC). To the surprise of many panelists, Matanoski, who is also an RAC member, said that the committee expected a justification for the release of the cancer report, in addition to recommendations for revising it.

The RAC's support for the report increased after Matanoski and Dr. Kelly Clifton presented possible mechanisms of interaction that could explain low-level EMF effects, at a May 20-22 meeting in Montgomery, AL. "The committee now seems to be less inclined to discount the EMF issue," the SAB's Conway told *Microwave News*. Members of the RAC decided that they will review the panel's report at a public meeting tentatively scheduled for mid-September.

The San Antonio meeting was called to review SAB reports—on epidemiology, on physics and on in vivo and in vitro studies—that were prepared by three groups of panel members following the SAB subcommittee's first meeting in January in Washington, DC (see *MWN*, J/F91).

While praising the "thorough nature" of EPA's review, the epidemiology group found that there was "too much unwarranted speculation about causal interpretation...giving emphasis to positive findings while de-emphasizing negative ones." Dr.

SAB Subpanel Members

Epidemiology Group: David Bates, Vancouver, BC, Canada; Patricia Buffler, University of Texas, Houston; Robert Harris, University of North Carolina, Chapel Hill; Clark Heath,* American Cancer Society, Atlanta, GA; Nan Laird, Harvard University, Boston, MA; Genevieve Matanoski, Johns Hopkins University, Baltimore, MD; and Donald Pierce, Oregon State University, Corvallis. *In Vivo, In Vitro Group:* Craig Byus, University of California, Riverside; Kelly Clifton, University of Wisconsin, Madison; John DiGiovanni, University of Texas, Smithville; Granger Morgan, Carnegie-Mellon University, Pittsburgh, PA; Mary Ellen O'Connor, University of Tulsa, OK; and Bary Wilson,* Battelle Pacific Northwest Lab, Richland, WA. *Physics Group:* William Feero, Electric Research and Management, State College, PA; Charles Susskind,* University of California, Berkeley; and Richard Wilson, Harvard University, Cambridge, MA. *Free Agent:* Karim Ahmed, Princeton, NJ.

* Head of the subpanel.

Clark Heath, who drafted the group's report, concluded that, "There needs to be considerable rewriting of the epidemiology section."

Heath's group recommended that EPA add a separate section on exposure assessment. "It's a pretty good suggestion," EPA's Dr. Robert McGaughy, the project manager for the EMF–cancer assessment, told *Microwave News*.

The epidemiology group stressed the need for more emphasis on published, peer-reviewed studies and on those of greatest importance—which Heath declined to identify. Instead, he referred to an unpublished meta-analysis of 59 EMF–cancer studies by Dr. George Hutchison, presented last February at an Electric Power Research Institute epidemiology workshop (see p.8).

Dr. Charles Susskind provoked a lively exchange among the panel's epidemiologists when he asked whether they thought there had been any real progress since the publication of the landmark 1979 Wertheimer–Leeper study. On one side, Matanoski argued that, "We've come a long way considering how short a time it's been." She pointed to the "consistency" among studies, particularly the recent reports on male breast cancer and the residential childhood cancer studies. Dr. David Bates, the vice chair of the panel, agreed, noting that, "It is now much more difficult to dismiss the evidence out of hand." Indeed, Matanoski, who has often remarked on her own initial skepticism about EMF effects, said before the San Antonio meeting, "I went in with a completely negative attitude; I've changed my opinion."

On the other side, Dr. Patricia Buffler said that she was "somewhat frustrated" as an epidemiologist: "I don't think we've made a lot of progress." Buffler said that she was troubled by the "inconsistencies," especially in the occupational studies, although she conceded that the positive findings could not easily be dismissed.

Members of the physics group were at odds over a section of their report concerning testimony by Dr. Robert Adair, a Yale University physicist, who argued that EMF effects below 100 mG would violate the laws of physics. William Feero challenged the report's emphasis on Adair's opinion, arguing that the credibility of the entire EPA report should not depend on whether the agency can show that Adair is wrong. Susskind, who wrote the physics report, asked the panel to delete the references to Adair.

There was general agreement that the section on proposed mechanisms of interaction, especially cyclotron resonance, be reduced to a simple listing of the various models.

Following suggestions made at the January meeting, the in vivo and in vitro group advised treating extremely low frequency (ELF) EMFs and radiofrequency and microwave (RF/MW) radiation in separate sections. The group also asked for a shortening of the review of Dr. Bill Guy's experiment on the long-

White House's Allan Bromley in His Own Words

Over the past year, President Bush's science advisor, Dr. Allan Bromley, has been an active behind-the-scenes participant in the debate over the health effects of electromagnetic fields (EMFs). Last November, Bromley, who heads the White House's Office of Science and Technology Policy (OSTP), asked the Environmental Protection Agency (EPA) to delay the release of its report, Evaluation of the Potential Carcinogenicity of Electromagnetic Fields *(see* MWN, *N/D90). The reason, he told* Time *magazine (December 24, 1990), was that EPA's "findings of a 'positive association' between EMFs and childhood cancer are 'quite incorrect' " and would unnecessarily frighten "millions of parents." Below is an excerpt from an interview with Bromley on the public television program* TechnoPolitics *in which the host, Tim White, asked Bromley about his role in the negotiations that preceded the release of the EPA report. The show aired April 23.*

White: We mentioned that you're more involved in...the legislative and administrative process than science advisors have been heretofore. One of the things that stirred some controversy was a report coming out of EPA on EMFs that you had a big role in squashing. Why did you do that, Dr. Bromley?

Bromley: First of all, I would have to correct that. I did not squash the report. I simply required that an introduction be written that put the report in somewhat better context. The report addresses an area that is of importance because a great many of our citizens are interested. The question is, does the presence of electrical wiring have health effects on humans? That's the simplest form. The research that's been done is spotty, it has not been complete, much remains to be done. EPA did a very workmanlike job of pulling together the work that had been done, pulling it all together in one place. No problem with that; it was a fine report. There was then an executive summary which perhaps went a little farther toward drawing out a causal relationship between the presence of EMFs and human cancer.

My role as science advisor to the President is to be sure that statements that come out of this administration are based on sound science. And so my only contact in fact with this report was to insist that a presentation that had been made to me and to various other people, which included that statement that evidence had been adduced for a causal relationship was not supported by the science.

White: By the science as presented by EPA.

Bromley: That's correct.

White: Let's stay with this issue, if we may, for just a moment, because clearly EMFs, if in fact they do have negative health effects for human beings, could affect all of us. You and I are sitting in profound—

Bromley: Of course.

White:—EMFs right here in this studio. How do you as the science advisor assess your role when there are competing interests?

Bromley: My role is simply to be sure that we use the best science, the best technology, that is available anywhere in the world and that our statements are based on sound science and technology.

White: Is that the kind of decision to be made in the White House science office, or is that the kind of decision to be made in laboratories or perhaps on Capitol Hill?

Bromley: The decision eventually, in cases of this kind, where the laboratory data are anything but complete, will necessarily be made at a political level, and that implies eventually, if it isn't resolved somewhere else in the bureaucracy, it comes to the White House.

term carcinogenic effects of RF/MW radiation (see *MWN*, J/A90).

With respect to ELF EMFs, the group recommended that EPA make it a priority to determine the "relevant" exposure parameters responsible for EMF effects, particularly in light of Peters's results. The group stressed the need to address intermittent and fast-changing EMFs as well as effects on animals with known sensitivities to the geomagnetic field (see *MWN*, M/A91).

The SAB panel heard invited talks by Drs. Arthur Pilla, Russel Reiter and Asher Sheppard. Pilla, of the Mount Sinai School of Medicine in New York City, presented data on the beneficial effects of pulsed low frequency EMFs on bone growth. The panelists were particularly interested in using these data to counter Adair's criticisms.

Reiter, of the University of Texas Health Science Center in San Antonio, showed that quick changes in magnetic fields can depress the pineal gland's production of the hormone melatonin (see *MWN*, J/A90). Bary Wilson told the panelists that he and other researchers at Battelle are beginning to replicate some of Reiter's findings. Sheppard, of the VA Hospital in Loma Linda, CA, spoke on ELF effects on cellular systems.

Unlike the Washington meeting, the San Antonio session attracted little public and media attention. Indeed, there were only three speakers from the audience. Four experts submitted written comments on behalf of the Utility Health Sciences Group (see *MWN*, J/F91).

Drawing on his long experience of serving on advisory boards, Bates suggested that the panelists give a "written endorsement" of the group's final report—to prevent their later renouncing sections of the document under public pressure. "There are people out there who are paid to discredit the [EPA] report as a whole," he said.

The subcommittee's next public meeting will be held in Washington, DC, July 23-25. A smaller group consisting of Matanoski, Bates, Dr. Karim Ahmed and the three study group leaders—Heath, Bary Wilson and Susskind—assembled in Washington June 3-4 to draft a document incorporating the recommendations in the groups' reports. The subcommittee plans to complete its report soon after the July 23-25 meeting.

EPA Funding *(continued from p.1)*

$2 million to EPA and $200,000 to the National Institute of Standards and Technology (NIST) for fiscal year 1992, which begins October 1, 1991. The measure would increase EPA funding for EMF research to $3 million annually for 1993 and 1994.

The allocation more than doubles the $940,000 requested by President Bush, according to a committee staffer. Before the funds can be appropriated, however, the $2.2 million must be approved by both the House and the Senate.

The bulk of EPA's funding—$1.5 million—is specifically provided for "a grant to the private sector" for EMF health effects research. The committee's report accompanying the legislation explains that the panel expects the Department of Energy (DOE) to match the $1.5 million, bringing the total federal contribution to $3 million. The report also suggests for the first time that the federal government's contribution could be less than half of the total project budget. The committee wants the NIST to develop measurement technology and protocols that can contribute to health effects research.

During the debate on Brown's amendment, a question was raised as to whether the private sector provision refers to the Health Effects Institute (HEI), the Cambridge, MA, group which is beginning a feasibility study for a possible EMF research program funded jointly by public and private sources (see *MWN*, M/A91 and p.3). A committee aide said that Brown has no specific recipient in mind.

In its report, the committee pressed EPA's Reilly to prevent political interference in the agency's analysis of EMF–cancer risks (see *MWN*, M/J90, N/D90 and J/F91):

> The questions raised in the EMF controversy are profoundly disturbing to the American public. This is evident from the growing number of legal actions filed around the United States relating to the siting and construction of electrical transmission lines. Thus, the development of a scientific consensus, based on rigorous, well-designed and replicated investigations, is critical to our understanding of the actual risks posed to populations by EMF exposure. The committee is profoundly concerned, therefore, by the events surrounding the publication of the report *Evaluation of the Potential Carcinogenicity of Electromagnetic Fields* and its review by the Science Advisory Board [SAB]. Unexpected intervention by the science advisor to the President in November 1990 delayed publication of the report. A number of witnesses before the January 1991 hearings of the [SAB] were supplied by a law firm which represents a number of utilities and which has in the past litigated cases relating to EMFs for utilities. In an issue already inflamed in the public mind, this committee expects that the evaluation of scientific evidence and the transmission of expert consensus to the administrator by the [SAB] will take place in a climate unaffected by political considerations. Interference with the proceedings of the board raises grave threats to the credibility of its findings and recommendations. This committee reminds the administrator of his responsibility to shelter the [SAB] from undue outside influence.

UPDATES

MEETINGS

EMF Sensitivity... Swedish Minister of Labor Mona Sahlin is taking an active interest in hypersensitivity to EMFs. On April 9 in Stockholm, Sweden's leading experts briefed Sahlin and an overflow crowd on the latest findings on EMF allergies. At the outset, Sahlin made clear that she is concerned. "I want these questions to be handled seriously," she said in her opening remarks. "The important question is not, 'What caused a person's disability?' It is, 'How can we intervene at an early stage?'" Hypersensitivity is becoming a major issue in Sweden. As of

April 1991, the Union of Those Injured by Electricity and VDTs numbered 1,200, up from just 220 in April 1988. Among the speakers at the briefing were NIOH's Dr. Bengt Knave, NBOSH's Dr. Kjell Hansson Mild, SWEDAC's Merih Malmqvist and NIRP's Lars Erik Paulsson. Knave dismissed claims that hypersensitivity is solely a psychological illness, though he allowed that it, like other health problems, does have a "psychosomatic aspect." He said that EMF hypersensitivity can be triggered by many factors, including personality (ambition may be a risk factor) and job design. He estimated that the debate on this issue is about where the debate on chemical solvents was 15 years ago. (For more on EMF sensitivity, see *MWN*, M/A87.)

Battelle EMF Seminar...Battelle, DOE and EPRI will host an August 1–2 conference at the Battelle Pacific Northwest Lab in Richland, WA, on *Electromagnetic Fields and Public Health Concern: A Knowledge Base for Informed Decision Making*. Speakers will include: Battelle's Drs. Bary Wilson and Larry Anderson, EPRI's Greg Rauch, Dr. William Kaune of Enertech Consultants, Dr. Ray Neutra of the California Department of Health and Dr. Granger Morgan of Carnegie–Mellon University. The cost is $395.00. For more information, contact: Carla Belcher, Battelle Pacific Northwest Lab, PO Box 999, Richland, WA 99352, (509) 375-3615.

PEOPLE

After almost ten years as the editor of the *Journal of Bioelectricity*, Dr. **Andrew Marino** will hand over the reins on June 1 to Dr. **Stephen Smith**, a professor of anatomy and neurobiology at the University of Kentucky in Lexington. In a telephone interview, Smith said that Marcel Dekker, Inc., of New York, NY, will publish one issue in 1991 and two in 1992, and plans to go to a quarterly schedule in 1993. From his office at the Department of Orthopaedic Surgery at Louisiana State University Medical Center in Shreveport, Marino explained that he could not sustain his research interests and continue editing the journal....EPA's Office of Radiation Programs (ORP) has a new acting director, **Margo Oge**, formerly director of EPA's radon division. In April, ORP's former director, **Richard Guimond**, was named the agency's deputy assistant administrator for solid waste and emergency management.

VDTs

Newspaper Avoids EMFs...*The Boston Globe*, New England's largest daily newspaper, is redesigning its offices to keep at least three feet between workers and the backs and sides of VDTs. The move was announced in an April 2 letter from Dr. Terrence O'Malley, the paper's medical director, who acknowledged that the action would "result in some disruption and inconvenience, but the overall result will be less exposure to weak magnetic fields." O'Malley explained that, "There is sufficient reason to take steps to reduce exposure until such time that research establishes the absence of significant biological effects from VDT fields."

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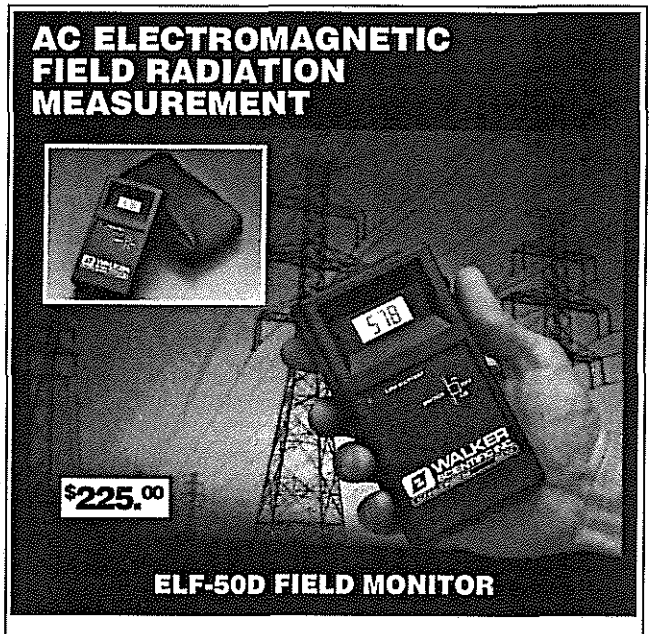
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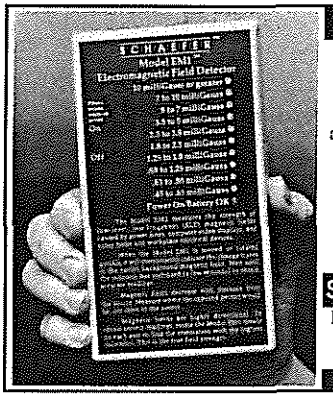
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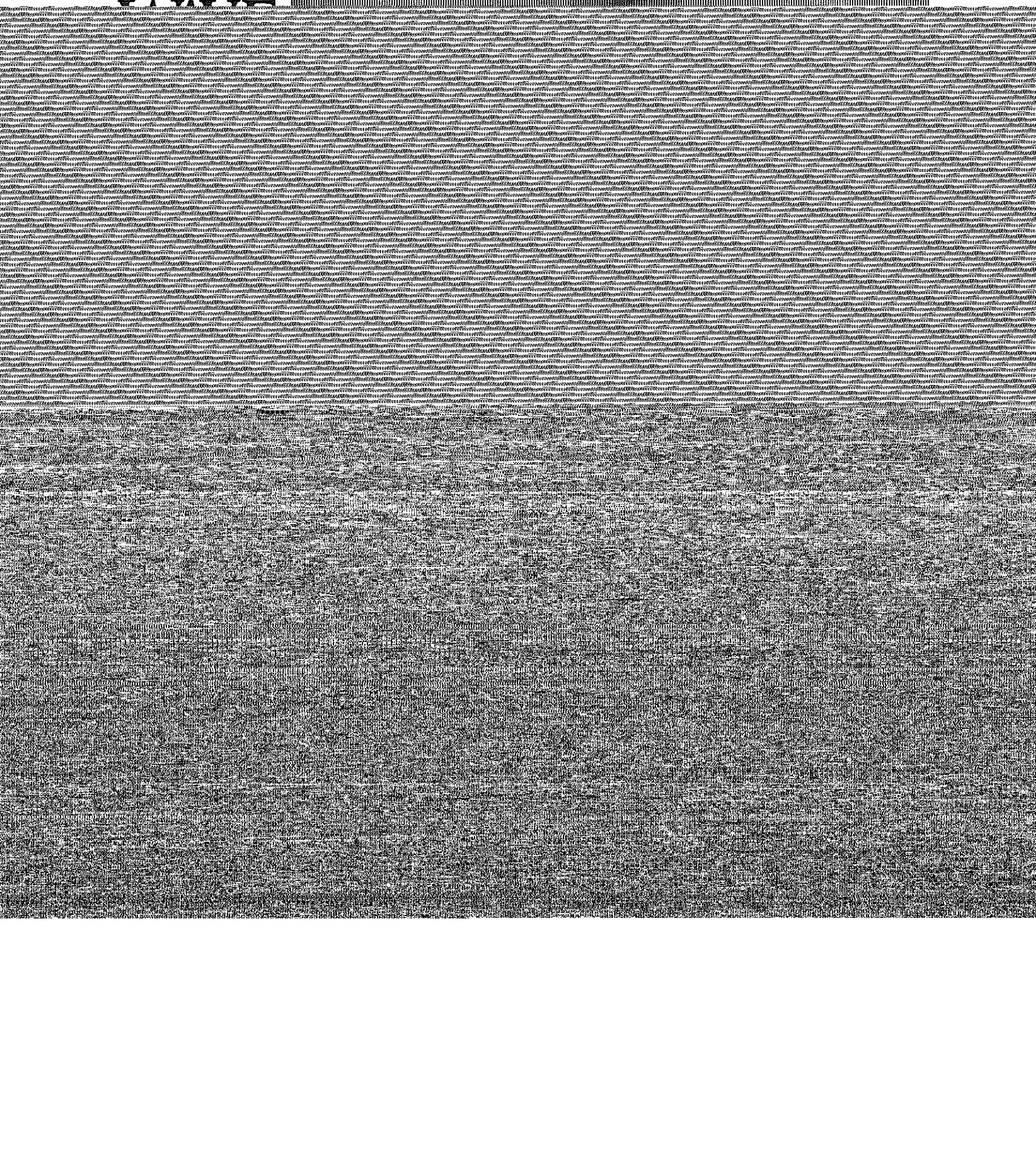
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« Power Line Talk »

The results of two major **Swedish epidemiological studies** will be announced in Stockholm on September 30, according to Rolf Lindgren of the Swedish State Power Board. The meeting is being organized by the principal sponsor of the studies, the Swedish National Board for Industrial and Technical Development, known as NUTEK. (The Swedish National Energy Administration is part of NUTEK.) Dr. **Anders Ahlbom** of the Institute of Environmental Medicine at the Karolinska Institute in Stockholm will present the findings of his case–control study of adult and childhood cancers and residential exposures to EMFs (see *MWN*, M/J87 and N/D89). And Dr. **Birgitta Floderus** of the National Institute of Occupational Health in Solna will present the results of her study of leukemia and brain tumors among EMF-exposed workers (see *MWN*, N/D89). Lindgren also reports that a small number of individuals will be briefed on the results on September 18 to give them an opportunity "to prepare statements and alert people in key positions." Both Ahlbom and Floderus are expected to report some data at the *1st World Conference for Electricity and Magnetism in Biology and Medicine* in Orlando, FL in mid-June and to present the final results at the DOE review in San Diego, CA in November.

«« »»

Last August, Congress asked the National Academy of Sciences–National Research Council (**NAS-NRC**) for a review of ELF health effects and allocated $600,000 for the study (see *MWN*, S/O91). But work on this project has yet to begin. As of mid-May, the **DOE** (the conduit for the funds in its role as lead agency for EMF research) has not entered into a contract for the study. "It's still going through the DOE process," Dr. **Dennis Mahlum**, the project officer at the NAS-NRC's Board on Radiation Effects Research, told *Microwave News*. Mahlum does not anticipate selecting a chairman or other panel members for the study until he has a signed contract.

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Particle physicist **David Jackson** has returned to the idea that a simple back-of-the-envelope calculation can end the controversy over EMF health effects. Writing in the April 1992 *Proceedings of the National Academy of Sciences*, Jackson argues that the link between ELF EMFs and cancer can be tested by comparing overall cancer mortality with the generation of electricity in the U.S. since 1900. And this comparison has led him to believe that "stray 50 or 60 Hz EMFs pose no significant hazard to the average individual." He adds that his conclusions "will not come as a surprise to scientists concerned with the issue." Maybe they are not surprised (the argument has been raised before, see *MWN*, J/F91 and J/A91), but several epidemiologists quoted in the media are not impressed either. "[T]here are so many things going on over that period—new drugs, new treatments, new causes of cancer—that [Jackson's analysis] really doesn't tell us anything," Dr. **David Savitz** of the University of North Carolina told the *Los Angeles Times* (April 15). Dr. **Richard Stevens** of the Battelle Pacific Northwest Labs was more blunt: "This is a fatuous piece of work." Also quoted in the *Times*, Stevens allowed that Jackson's approach makes "intuitive sense" but added that with such reasoning, "you couldn't even show any significant effect of smoking on cancer...." A similar debate is ongoing in *The Health Physics Society's Newsletter*. The May issue includes a letter from Dr. **Joseph Kirschvink** criticizing Dr. **Robert Adair**'s October 1991 article, which compared childhood leukemia rates in Connecticut with per capita power consumption. "Kirschvink misrepresents my paper and then attacks those misrepresentations," Adair wrote in a response in the same issue.

«« »»

In late March, Dr. **Andrew Sivak** resigned as the president of the Health Effects Institute (**HEI**). Dr. **Charles Powers**, the founder of the institute, is now serving as the acting president. The reasons for Sivak's departure are unclear, though there are indications that the board asked for his resignation. In an interview, Powers would only say that the board made no sudden decisions. HEI is continuing to assemble an EMF research plan, which is scheduled to be made public later this year (see *MWN*, S/O91, N/D91 and M/A92). "It's going to take a truly complex piece of detective work" to sort out EMF effects, Powers said.

«« »»

Women on Long Island, NY are pressing for federal funding to study the possible causes of high rates of **breast cancer** in the region—especially the potential role of EMFs. On May 8, EMFs came up at a congressional hearing, held on Long Island by Rep. James Scheuer (D-NY), which looked at the possible link between toxic chemicals and breast cancer. Three days later, a panel of experts from the federal **Centers for Disease Control** (CDC) in Atlanta, GA came to New York to listen to residents' concerns. But research money is uncertain. "My guess is that we probably won't recommend a study," Dr. **Marion Nadel**, a CDC epidemiologist, told *Microwave News*. A final decision is due in December. "The CDC has been dragging its feet for a long time," insisted Fran Kritchek, cochairwoman of the 1 in 9 Long Island Breast Cancer Action Coalition. "I hope the CDC and the state will confront the issue in a more aggressive manner." Dr. **James Melius**, director of the state health department's division of occupational health and environmental epidemiology, told *Microwave News* that breast cancer is "an issue that needs to be addressed." He said the department is examining air pollution and EMFs as possible risk factors. "Based on those results we will decide whether to conduct further studies."

But Melius said he didn't know if funds would be available. In the meantime, the community is impatient. "We can't afford to wait six months for the CDC to decide," said Barbara Balaban, director of the Breast Cancer Hotline & Support Program at the Adelphi University School of Social Work. "In six months there will be 23,000 more deaths and 90,000 more cases of breast cancer."...Battelle's Dr. **Richard Stevens** and Dr. **Scott Davis** of the Fred Hutchinson Cancer Research Center in Seattle, WA have received funding, as expected, for a study of the influence of EMFs and/or light-at-night on breast cancer in women (see *MWN*, N/D91). The study began on May 1.

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Although the House of Representatives has voted to shift federal EMF research authority from the **DOE** to the **National Institute of Environmental Health Sciences** (see below), the DOE is continuing its series of workshops to formulate a coordinated national research program by mid-summer. The first meeting, held on May 4-5 in Crystal City, VA, focused on policy issues. Participants included representatives of the NERP steering committee, APPA, EEI, FDA and the Florida DER. Dr. Richard Ball of DOE's Office of Domestic and International Energy Policy ran the meeting. The DOE has scheduled two more workshops—one on science and engineering in Arlington, VA on June 3-5, and the other on risk communications in Crystal City on June 8-9. In addition, the DOE is planning public hearings for June 29 and July 9 in Denver, CO and Philadelphia, PA, respectively. (See also, *MWN*, N/D91 and J/F92).

House Taps NIEHS To Lead National EMF Research Effort

The House of Representatives has selected the National Institute of Environmental Health Sciences (NIEHS) as the lead federal agency for electromagnetic field (EMF) health effects research, replacing the Department of Energy (DOE).

Under legislation passed by the House on May 27, NIEHS will receive $60 million for research and $5 million for communications, both to be spread over five years. An interagency committee chaired by an NIEHS official will set the research agenda.

The EMF program is included in the national energy strategy bill, H.R.776. The Senate version of the energy bill, approved earlier this year, does not contain any EMF provisions, and a joint House–Senate conference committee must resolve all differences between the two measures. Congressional leaders expect to enact the energy legislation this year.

In selecting NIEHS, the House rejected the DOE designation Congress made last year, according to an aide to the House Energy and Commerce Committee (see *MWN*, S/O91). NIEHS provides greater scientific credibility than the DOE, he explained. Committee staffers had met with officials from NIEHS, the DOE and the Environmental Protection Agency (EPA). "It was clear to everybody that NIEHS was the best choice," he said.

The EMF language approved by the House was a compromise between the Energy and Commerce Committee, which favored NIEHS, and the House Science, Space and Technology Committee. The science committee had named the DOE as the lead federal agency in EMF legislation it appended to H.R.776 in March (see p.13 and *MWN*, N/D91, J/F92 and M/A92).

But Rep. George Brown (D-CA), chairman of the science committee and the primary congressional supporter of an expanded EMF research effort, said through a spokesman that he is "very supportive of the lead role of NIEHS." Except for the NIEHS designation, the EMF provisions in the energy bill are generally consistent with the original science committee bill.

Sources said that the DOE did not try to block the NIEHS selection, but those who track EMF legislation expect the department to fight to retain its lead role in the House–Senate conference. DOE officials did not respond to requests for comment.

NIEHS, based in Research Triangle Park, NC, supports biomedical research on the human health effects of biological, chemical and physical agents. It is part of the National Institutes of Health within the Department of Health and Human Services. Dr. Kenneth Olden, the director, was formerly director of the Howard University Cancer Center and chairman of the oncology department at Howard's medical school, both in Washington, DC.

Dutch Advisory Panel Discounts ELF Health Risks

An advisory group in The Netherlands has concluded that there are not enough reliable data to support a link between the extremely low frequency (ELF) EMFs from power lines and appliances and the development of cancer, pregnancy problems or other health effects.

The ad hoc committee, set up by the Health Council of The Netherlands, recommended that standards be based on limiting the internal currents induced in the body by ELF EMFs—the approach adopted by the International Non-Ionizing Radiation Committee of the International Radiation Protection Association (see *MWN*, M/J89 and J/F90).

"Results of the epidemiological studies as are now available do not justify the conclusion that there exists a relation between prolonged domestic or professional exposure to ELF EMFs and adverse health effects," the committee wrote in a report released on April 8 in The Hague. The committee did recommend that "monitoring of the developments in this field be continued and the data reevaluated in five years."

The committee also found "no compelling reasons to determine in detail the ELF EMF strengths to which the Dutch population is exposed," because of the uncertainties over which char-

acteristics of the EMFs, if any, have an impact on health.

Dr. Eric van Rongen, the scientific secretary of the Health Council, explained to *Microwave News* that no decision has yet been made on whether a new review will be undertaken in five years. If such a review is approved, a new committee will be formed.

The seven-member Dutch committee was chaired by Dr. A. van Oosterom, a professor of medical physics at Catholic University in Nijmegen.

The 94-page report, *Extreem Laagfrequente Elektromagnetische Velden en Gezondheid* (ELF EMFs and Health), Report 1992/07, is available for 32.50 Dfl (approximately $16.00) from: Public Relations Department, Health Council of the Netherlands, PO Box 90517, 2509 LM The Hague, The Netherlands, (31+70) 347-1441. The report is in Dutch; an executive summary is available in English.

Defining Prudent Avoidance Policies State by State

From Connecticut to California, states are grappling with prudent avoidance. An EMF study group in Connecticut has refused to endorse the policy, while a similar committee in Texas endorsed it but has recommended no changes in power line routing policies. Colorado has called for a hearing to define its program better. And Wisconsin has taken the lead in seeking to reduce public exposure to EMFs.

Current evidence "does not permit firm judgments about possible adverse effects of ELF magnetic fields on human health," the Connecticut Academy of Science and Engineering (CASE) wrote in its April 1 report. "It would be inappropriate...for public authorities to recommend 'prudent avoidance'," it concluded.

Connecticut Health Commissioner Susan Addiss told *Microwave News* that she agrees with CASE's report and that she supports the group's recommendations.

Texas' EMF Advisory Committee urged the state Public Utility Commission (PUC) to stick by its policy of prudent avoidance, but only up to a point. "We...recommend that, at this time, the PUC not expand existing routing criteria to include concerns regarding health effects of EMF exposures," the committee stated in a report, issued in March. Texas' policy since 1976 has been to avoid population centers, historical sites and existing utilities when siting transmission lines. "It was more for aesthetic reasons," PUC spokesman Mel Eckoff said in a telephone interview. "Concerns about health effects of EMFs might have been informally included over the years."

Earlier this year, the Wisconsin Public Service Commission (PSC) ordered utilities to use low EMF designs in new or upgraded transmission and distribution lines and to consider population exposure to EMFs when planning the lines (see *MWN*, J/F92). The PSC did not use the term "prudent avoidance" in its May 7 formal order because "it can mean many things to many people," PSC aide Dan Dasho told *Microwave News*. "But it would be fair to say that Wisconsin goes beyond commonly held perceptions of prudent avoidance," he added.

On May 11, the Colorado Supreme Court reversed a ruling by the Douglas County District Court that denied the Public Service Company's request to upgrade transmission lines. The Douglas County Board of County Commissioners filed a petition on May 26 requesting that the Supreme Court schedule a rehearing, according to the board's attorney, Steven Denman of the Denver firm of Sherman & Howard. The latest decision was a victory for the state PUC, which had approved the upgrade in 1989 (see *MWN*, N/D89 and M/A91). At that time, the PUC affirmed that, "Prudent avoidance means the striking of a reasonable balance between avoiding potential harm and the attendant costs and risks." Following this policy, the PUC claimed that the costs outweighed the benefits of burying the Douglas County power lines.

Meanwhile, Colorado is moving forward with attempts to better define prudent avoidance. On April 29, the PUC proposed to open a hearing in August "to determine what standards should apply to electric and magnetic field strength when a utility...builds new, or upgrades existing, electrical facilities." One commissioner suggested adopting Florida's rules for EMF exposure (see *MWN*, M/A89).

Members of an EMF advisory group in California disagreed

Prudent Avoidance Sought in Union Contract

Workers at Detroit Edison in Dearborn, MI are asking the utility to adopt a policy of prudent avoidance.

Local 223 of the Utility Workers Union of America (AFL-CIO) has proposed adding language to its contract specifying that Detroit Edison post warning signs indicating the strength of ambient EMFs, install physical barriers to prevent entry to areas "where EMFs exceed average levels typically found in homes," train workers in all aspects of recognizing and mitigating EMFs, assess typical worker exposures and, when planning or rebuilding power lines, favor designs that minimize EMF exposures.

"It's stunning how interest has picked up as the members learn about EMFs," the union's Hal Nixon told *Microwave News*. He explained that of the 440 Detroit Edison substation employees, three men lost children to leukemia and a fourth had a child born with a brain tumor—and there has been a general excess of leukemia among the workers themselves. There are some 2,900 Detroit Edison employees in the union.

Frank Agosti, a senior vice president at Detroit Edison, declined to discuss the union proposal. "It's our policy not to comment on contract negotiations," he said.

Excerpts from the State Reports

Colorado...

• Until scientific findings are more conclusive, facilities should be designed and located using methods to mitigate, to the extent practicable, involuntary exposures to the public.
• Increased research, at all levels, that is coordinated to maximize its effectiveness, is in the public interest.

A copy of the April 29 written order, decision no. C92-600, is available for $3.00 from: Colorado PUC, Attn: Joyce Reed, 1580 Logan St., OL2, Denver, CO 80203, (303) 894-2000, ext.319.

Connecticut...

• Guidelines and standards currently in force in various jurisdictions...do not appear to be exceeded in Connecticut. The academy does not see any particular utility [for the state] to adopt these guidelines....
• Absolute proof of the occurrence of adverse effects of ELF fields at prevailing magnitudes cannot be found in the available evidence....
• There are some immediate or acute biological effects of ELF electromagnetic fields at levels that commonly occur....These effects are not seen as a health hazard.
• The totality of the epidemiological studies suggests that if adverse health effects from residential EMF exposure exist, they are not likely to make a large contribution.

A copy of the report, *EMFs: Electromagnetic Field Health Effects*, is available for $10.00 from: CASE, 410 Asylum St., Room 640, Hartford, CT 06103, (203) 527-2161.

Texas...

• There is insufficient evidence regarding human health effects of EMFs to provide the basis for a health-based standard.
• Neither the PUC nor other state authorities [should] attempt to set EMF standards through guidelines, regulations or legislation.
• [The PUC should] take action regarding the EMF health effects issue only when, or if, action can be justified on a public health basis.
• A carefully coordinated and comprehensive national research agenda with adequate funding from a mix of governmental and nongovernmental sources is needed.

A copy of the report, *Health Effects of Exposure to Power Line Frequency EMFs*, is available for $32.90 from: PUC of Texas, Attn: General Records, 7800 Shoal Creek Blvd., Austin, TX 78757, (512) 458-0225.

Wisconsin...

• It is reasonable to conclude that reducing exposure to EMFs increases public safety. Doing nothing, while waiting for conclusive evidence about human health effects, is not a reasonable response to the potential risks associated with EMFs.
• The state of scientific knowledge about EMFs does justify continuing concern regarding its potential effect on human health.
• Utilities should consider supporting other EMF research programs in addition to those that are industry sponsored, including the National EMF Research Program....

A copy of the May 7 written order, docket no. 05-EP-6, is available from: PSC of Wisconsin, Hill Farms State Office Bldg., PO Box 7854, Madison, WI 53707, (608) 267-0510.

on whether to advise prudent avoidance, but, in a March report, recommended that the state PUC consider setting exposure standards. The group—whose 17 members represent diverse interests—called for state research, education and mitigation policies (see *MWN*, M/A92).

Both the Texas and Connecticut groups also encouraged further research on EMFs and health, but neither group recommended a state research program. Texas did endorse a national public–private EMF research program.

Texas' eight-member committee—an ongoing group appointed by the PUC in 1988—is made up of representatives from utilities, state government and universities.

CASE, based in Hartford, CT, is a private, nonprofit group whose 180 members are divided two to one between academia and industry, respectively, according to David Wetstone, the group's secretary. "CASE intends to model itself after the National Academy of Sciences [NAS] and do for the state what the NAS does for the federal government," he said.

The Connecticut EMF study cost about $5,000 and was directed by Yale University epidemiology and public health professor Dr. Jan Stolwijk, who is a member of the International Radiation Protection Association's International Non-Ionizing Radiation Committee. "Utilities are aware that [prudent avoidance] is an issue," Stolwijk told *Microwave News*. "They will try to do what they can."

Legal Notebook

Electrical Worker's Cancer Claim Rejected

The Washington State Department of Labor and Industries has rejected a claim that an electrical worker's death from leukemia was caused by his on-the-job exposure to EMFs. "The evidence fails to establish that the death resulted from an occupational exposure," stated William Travis, a pension adjudicator at the agency, in a March 25 decision.

Robert Pilisuk had worked as a cable splicer and maintenance electrician at Seattle City Light for seven years, until his death at the age of 44 in April 1989. Pilisuk's widow, Mimi, of Seattle, filed the pension claim in March 1991 (see *MWN*, M/A91).

"The case is just starting," said Michael Withey, Pilisuk's attorney, who appealed the decision to the Board of Industrial Insurance in Olympia on April 22. Withey, of the Seattle firm of Schroeter, Goldmark & Bender, said he would request health records from Seattle City Light to see if there is a leukemia cluster among its workers.

TLPJ Seeks Release of EMF Documents

In an attempt to give the public access to what it calls "potentially crucial" information about EMFs, Trial Lawyers for Public Justice (TLPJ), a public-interest legal group, has filed a motion in the superior court of Douglas County, GA to intervene in an EMF personal injury suit.

In its May 8 action, TLPJ seeks to block a protective order that would allow a utility, the Oglethorpe Power Co., based in Tucker, GA, to decide which of its documents it wants to treat as confidential.

"The public has a right to this information," insisted TLPJ lawyer Kieron Quinn of the Baltimore, MD firm of Quinn, Ward & Kershaw. "Millions of people could be completely unaware of the dangers of the power lines in their neighborhood," he said. Quinn told *Microwave News* that Oglethorpe Power has since withdrawn its request for confidentiality. A spokesman for the utility declined to confirm this, but, if true, the case would become moot.

Nancy Jordan and her family filed a lawsuit in July 1991, claiming that EMFs from power lines owned by Georgia Power and by Oglethorpe Power caused her non-Hodgkin's lymphoma (see *MWN*, S/O91). TLPJ filed its request on behalf of the Robert Carl Strom Foundation, an EMF education organization.

Michigan Utility Sued for Stray Voltage

A dairy-farming couple in Michigan filed a lawsuit against the Jackson-based Consumers Power Co. (CPC), claiming that stray voltage from the utility's distribution lines caused "severe losses" to their dairy business. Vernon and Sally Lanphear of Monterey, MI filed the claim in Allegan County Circuit Court on March 30.

The Lanphears, who have run their dairy farm since 1987, said their cattle produce less milk and have difficulty conceiving because of stray voltage from CPC power lines on their property. The couple claimed that their income has "substantially decreased" and that their property is "worthless and unsalable" because of the utility's negligence.

"We think Michigan Power has an obligation to provide electric power that doesn't damage property and affect business on that property," said the plaintiffs' lawyer, Jack Dougherty of the San Francisco, CA firm of Belli, Belli, Brown, Monzione, Fabro & Zakaria.

But the utility argues that any injuries alleged by the plaintiffs are not its responsibility. "We don't believe we contributed to the problem," James Dempsey, a CPC attorney, told *Microwave News*. "The stray voltage might be coming from their own farm equipment." Dempsey has requested that the court dismiss the case due to a lack of evidence.

In October 1990, a family of dairy farmers in Minnesota was awarded $1 million in a stray-voltage suit (see *MWN*, N/D90).

Wisconsin Electric Offers $25 Million Settlement

The Wisconsin Electric Power Company will pay $25.2 million to the family of a boy who was critically injured when he put his hands into an unlocked electrical transformer box. The settlement—the largest in a Wisconsin personal injury case—was reached on March 11 between lawyers for the utility and Willard Techmeier, the attorney for the boy's family. Techmeier is with the Milwaukee firm of Techmeier & Lowe.

On October 2, 1990, Matthew Brown, then five years old, was visiting relatives in Oak Creek when he touched a Wisconsin Electric transformer. Doctors later amputated his severely burned left arm and part of his right arm. In a public statement issued two days after the accident, the utility accepted responsibility for its actions and said it would replace or retrofit other such transformers. A padlock was missing from the box Brown opened.

HIGHLIGHTS

NCRP Steps Up NIER Activities

The National Council on Radiation Protection and Measurements (NCRP) has set up a new committee to promote its work on non-ionizing electromagnetic radiation (NIER). Scientific Committee 89 (SC89) will serve as an "umbrella" group to coordinate the council's activities on public, occupational and medical exposures to NIER. SC89 will cover NIER from DC to ultraviolet (0-10^{15} Hz).

The committee was set up because NIER "is going to be very important over the next decade," Dr. Tom Tenforde, the chairman of SC89, told *Microwave News* from his office in Richland, WA, where he is chief scientist at the Battelle Pacific Northwest Labs' Life Sciences Center. Tenforde, with the encouragement of NCRP President Dr. Charles Meinhold, first proposed the initiative last year. The NCRP's board of directors, on which both Tenforde and Meinhold sit, approved the creation of SC89 at its quarterly meeting on April 2.

The committee's first task is to help three existing committees finish their projects. Tenforde said, "Umbrella committees can be very helpful in assisting committees to complete their reports."

Tenforde said that he is considering starting new committees on: lasers in medicine; MRI and in vivo spectroscopy; hyperthermia procedures and applications; and ultraviolet light. Each of the committees would review dosimetry, exposure assessment, biological effects, mechanisms of interaction, public and occupational exposure limits and mitigation techniques. The establishment of such committees will depend on the availability of funds.

SC89 may also issue "commentaries," which would be less detailed than committee reports and which would take less time to complete, Tenforde said. He cited video display terminals and police radar as possible topics for commentaries.

The three ongoing efforts that will now be overseen by SC89 are: SC67, "Biological Effects of [Static] Magnetic Fields," chaired by Dr. Dennis Mahlum, formerly of Battelle and now at the National Research Council in Washington, DC; SC78, "Practical Guidance on the Evaluation of Human Exposures to Radiofrequency Radiation," chaired by Richard Tell of Richard Tell Associates Inc. in Las Vegas, NV; and SC79, "Extremely Low Frequency Electric and Magnetic Fields," chaired by Dr. Ross Adey of the VA Hospital in Loma Linda, CA. SC67 was set up in 1979-1980, and both SC78 and SC79 were established in 1984 (see *MWN*, D83, Ap84 and J/F86).

Mahlum's and Tell's reports are in final editing following council review, according to William Beckner, NCRP's staff officer for both committees. Dr. Constantine Maletskos, the staff officer for SC79, said that 90% of Adey's report is in draft form and that "the current plan is to get the report out by March 1993."

The NCRP has invited eight experts to join Tenforde on SC89. He is planning to hold a first meeting this summer. An NCRP staff officer has not yet been assigned to work with SC89.

U.S. Senator Seeks National Police Radar–Cancer Study

Responding to concerns over the possible health risks associated with traffic radar, Sen. Christopher Dodd (D-CT) has asked the National Institute of Environmental Health Sciences (NIEHS) to "initiate an epidemiologic study to see if hand-held traffic radar units pose a risk for cancer."

"Anecdotes of cancer clustering among police officers have become widespread," Dodd wrote in a May 26 letter to Dr. Kenneth Olden, the director of NIEHS. Based in Research Triangle Park, NC, NIEHS is part of the Department of Health and Human Services' National Institutes of Health.

In a related development, Sen. Joseph Lieberman (D-CT) has announced that he will hold a congressional hearing this summer on the health risks associated with police radar. Lieberman, the chairman of the Governmental Affairs Committee's subcommittee on consumer and environmental affairs, said, "I am struck by the lack of research, governmental oversight and

Other Police Radar Developments

RIT Study Shows Elevated Cancer Risks

Dr. John Violanti of the Rochester (NY) Institute of Technology (RIT) has found an elevated risk of cancer for police officers exposed to traffic radar, according to an analysis of questionnaires that the Police Benevolent Association of New York State (PBA/NYS) mailed to 6,000 active and retired members last November (see *MWN*, J/F92). Conclusions from the study are limited, however, because response to the survey was voluntary and only 164 officers replied.

"This was a good pilot study, a good starting point," Violanti said, adding, "Something is going on that we need to find out about." Officers who reported using hand-held radar had the greatest cancer risks: five of the nine officers who reported using a Kustom Signals HR-8 had cancer, and seven of 14 who reported using an MPH Industries K-55 had cancer; Violanti calculated that this was a 5.0-fold increase for users of the HR-8 and a 4.1-fold increase for users of the K-55.

Violanti also found statistically significant elevated risks for testicular cancer, colon cancer, thyroid cancer and breast cancer, though these were based on a small number of cases.

Violanti has written a more detailed questionnaire, which was mailed by PBA/NYS to 2,000 of its members. He said he would like to see a much larger cohort study: "You need to get a huge number of people, maybe 25,000 or 30,000 police officers nationwide."

Defendants Seek Dismissal In Bendure Case

A motion for summary judgment in the product liability lawsuit filed by Eric Bendure is set to be argued July 9 in U.S. District Court in San Francisco, CA. The defendants in the case, Kustom Signals Inc. of Overland Park, KS and MPH Industries of Owensboro, KY, are seeking to have the case dismissed. "They contend simply that it's not possible that these radar guns can cause cancer," Bendure's attorney, Jack Sweeney of Agoura Hills, CA, told *Microwave News*.

This is the first test of the scientific basis for these cases, Sweeney said. If the motion is denied, Sweeney has trial dates of August 11 for the Bendure case (see *MWN*, J/A91) and September 14 for the case brought by Steven Cottini (see *MWN*, S/O91). Both officers developed cancer after using police traffic radar.

A third police radar suit Sweeney is handling has been put on hold, following the death of the plaintiff, Leo Hutchison, on April 25. "We've chosen to withdraw the case for now and refile it as a wrongful death suit," Sweeney explained. Hutchison's wife and son will be plaintiffs in the new case.

New Case Filed In Ohio

An Ohio state trooper who has brain cancer has sued Kustom Signals and MPH Industries. Wayne Vessels's suit was filed March 23 in U.S. District Court for the southern district of Ohio. His wife is also named as a plaintiff.

The court allowed an expedited deposition due to Vessels's deteriorating health, according to his attorney, Michael Cassity of the Mt. Orab, OH firm of Cassity, Kelly and Wallace. Vessels's testimony was videotaped April 9.

Cassity told *Microwave News* that the officer was first diagnosed with skin cancer on the right side of his face in 1977. The cancer spread to his eyelid and then to his brain: "His prognosis is terminal." Cassity said his client used a Kustom MR-7 radar—mounted on the rear passenger window, inside the vehicle, facing forward—from 1972 until 1977. Even after he was diagnosed with cancer, he stayed on the force, using a dashboard-mounted MPH unit, which the Ohio state police began using in the late 70s. Vessels was forced to retire in 1986, Cassity said, when he lost his right eye to the cancer (see *MWN*, M/A91).

federal standards." He added that research into the biological effects of microwave radiation is "all but nonexistent."

Connecticut has been at the center of concern over the risks of police radar. On June 2, Governor Lowell Weicker signed HB5070, which outlaws the use of hand-held traffic radar by all police officers in the state. The measure was sponsored by state Rep. Joseph Adamo (see *MWN*, M/A92).

The Connecticut State Police and a number of local departments had already limited use of hand-held radar (see *MWN*, N/D91), following a campaign by the International Brotherhood of Police Officers (IBPO). The union estimated that 50-60% of the state's municipalities had agreed not to use their hand-held units. "This law is going to save an awful lot of lives because there were police officers who were still using hand-held radar," IBPO's Sam Franzo told *Microwave News*.

Franzo also praised Dodd's request, saying, "We've been calling for a national study for a year."

Dodd wrote that a case–control study "would be relatively inexpensive yet timely [and] might then prompt a more in-depth investigation." He concluded that, "The everyday work of law enforcement officers is already dangerous. As public servants, the least we can do is to assure them of a safe workplace."

The IBPO has been lobbying for health research. In a May 18 letter to Dodd, Kenneth Lyons, the union's national president, wrote that, "The IBPO believes a link exists between prolonged occupational exposure to hand-held traffic radar units and subsequent development of cancer." He added, "No comprehensive studies exist at any level to either confirm or repudiate any link."

The potential link between police radar and cancer has been widely reported in Connecticut and elsewhere (see *MWN*, S/O91, N/D91 and M/A92). The manufacturers of the radar guns are being sued by officers in Connecticut and four other states who have developed cancer (see p.7).

60 Minutes *Investigating Police Radar–Cancer Link*

Morley Safer, a correspondent for *60 Minutes*, the CBS television news magazine, is looking into allegations that police officers who are exposed to microwave radiation from hand-held traffic radar units face an elevated risk of developing cancer.

The segment will be aired this summer or in the fall, according to CBS producers. More Americans regularly watch *60 Minutes* than any other show on television.

SAB Issues Critique of EPA EMF Research Plan

The Environmental Protection Agency's (EPA) research strategy for electromagnetic fields (EMFs) was criticized for being vague and unfocused in a May 11 letter to EPA Administrator William Reilly from the Science Advisory Board (SAB).

The letter represents the consensus of 16 of the 17 members of an SAB subcommittee. Dr. Richard Wilson, a physicist at Harvard University in Cambridge, MA, refused to join the other panelists, *Microwave News* has learned. The letter said the dissent stemmed from "fundamental disagreement with EPA's approach."

The 16 members agreed on the need for EMF research because of the "almost universal exposure of populations to EMF throughout life." But the panel charged that EPA had grossly underestimated the cost and time needed to resolve the health questions: it put the price tag at up to $100 million a year for at least three to five years.

Earlier this year, the SAB panel issued its review of the agency's EMF–cancer report (see *MWN*, J/F92). The SAB has now completed its work on EMFs but will probably return to the issue when EPA completes its revision of the report.

Among the subcommittee's conclusions are:

- The level of detail in the document is insufficient for setting specific research goals and priorities.
- If EPA chooses to develop a scientifically credible research strategy independently, it should also propose a mechanism by which such a strategy can be implemented.
- Effects on [the] nervous system...should receive more emphasis.
- A research strategy must emphasize the more fundamental and far-reaching need for basic understanding of biological effects and biophysical mechanisms.
- High priority [should] be placed on identifying and replicating in several laboratories the few key experiments that can determine the reproducibility of effects that appear to challenge simple biophysical models.
- The identification of the relevant metric is critical both to formal risk assessment and to risk management should a significant risk be found to exist.
- Three applied research areas are not included in the EPA document in which the subcommittee recommends some limited effort be undertaken: risk perception, risk communication and risk management.

The members of the SAB subcommittee charged with reviewing the EPA plan had voiced many of these concerns at a public hearing last year (see *MWN*, J/A91).

For a copy of the SAB's review of *A Research Strategy for EMFs: Research Needs and Priorities*, contact: Lori Gross, SAB (A-101), EPA, 401 M St., SW, Washington, DC 20460, (202) 260-4126.

Magnetic Material Found in Human Brain Tissue

Researchers at the California Institute of Technology in Pasadena have isolated microscopic crystals of magnetite from samples of human brain tissue. "I was struck by the similarities between the human magnetite and the magnetite found in magnetic bacteria," said Dr. Joseph Kirschvink, who led the Caltech team, adding that the crystals "are shaped in such a way as to be

optimal for use as a magnet."

"It is *possible* that the presence of magnetite may mediate any health effects of EMFs," Kirschvink said, but he cautioned that, "In my opinion, the jury is definitely still out on whether EMFs actually do have health effects." He also warned that, "I want to be explicit about the fact that we have no evidence at this time that humans have a magnetic sense."

In a series of interviews, members of the bioelectromagnetics community expressed skepticism that this discovery was the key to the mechanism of EMF interactions. "This is a significant finding, but I doubt that it has anything to do with explaining 60 Hz biohazards," Dr. Robert Becker, the author of *The Body Electric* and *Cross Currents*, told *Microwave News*.

In their paper, which has been accepted for publication in the *Proceedings of the National Academy of Sciences*, the Caltech researchers explain how the magnetic particles might be affected by EMFs: "The magnetic torque from external alternating fields will induce mechanical oscillations in the particles, and the potential exists for such motions to do things like opening transmembrane ion channels." According to their calculations, the intensities of the 50 or 60 Hz fields would have to be slightly stronger than the Earth's static field—approximately 500 mG.

Kirschvink and his coworkers are not the first to have found magnetic materials in humans. In 1983, a team at the U.K.'s University of Manchester, led by Dr. Robin Baker, reported that bones from the human sinuses are magnetic (see *Nature, 301*, pp.78-80, 1983).

Kirschvink's paper has been widely publicized in the press. See, for instance, the *Los Angeles Times* (May 12), the *New York Times* (May 12), *Science* (May 15) and *The Economist* (May 16).

NIST and FAA To Test Avionics for Immunity to EMI

Under an agreement with the Federal Aviation Administration (FAA), the National Institute for Standards and Technology (NIST) will test the ability of electronic flight systems to withstand electromagnetic interference (EMI) from high-power radiofrequency and microwave (RF/MW) radiation.

Initially, the NIST will test the immunity of avionics to a variety of different sources, including broadcast antennas and high-power radars, Abbas Rizvi, the FAA program manager, told *Microwave News*.

The decision to use the NIST follows a May 4 congressional report pressing the FAA to perform independent testing. Aircraft makers claim that the FAA has no justification for its existing EMI policy of immunity to 100 V/m. The FAA bases the limit on tests carried out at its Atlantic City, NJ research facility, according to agency officials.

At a March 11 congressional hearing, Edward Stimpson, president of the General Aviation Manufacturers Association (GAMA), based in Washington, DC, testified that the FAA "has yet to conduct a reasonable test program," and he recommended using the NIST. At issue is $500,000 that Congress gave the FAA last year for testing but which the agency has not yet spent.

The FAA has not published a notice of proposed rulemaking concerning high-power RF/MW radiation, though it has had plans to do so for several years (see *MWN*, N/D89 and J/A90). Nevertheless, the agency applies the 100 V/m limit as a special condition on plane designs, Stan Green, an attorney for GAMA, told *Microwave News*. He contends that an official rule would "never get past the Office of Management and Budget [OMB], because the FAA has zero accidents and zero incidents" to justify the need for a rule. The OMB, an arm of the White House, evaluates proposed rules before they are published.

The congressional report accompanies the FAA's research legislation, H.R.4557 (House Report 102-511).

Navy Shelves Plans For Gulf Coast EMPRESS II Site

The U.S. Navy has announced that, due to "fiscal pressure," it no longer plans to use the proposed Gulf of Mexico site for its electromagnetic pulse (EMP) simulator, known as EMPRESS II.

The Navy has scaled back the EMPRESS II program and expects to complete only two ten-day trials per year, said Lt. Commander Joseph Osborne, who is in charge of the program at the Naval Sea Systems Command in Washington, DC. These tests can be performed at the Atlantic Ocean site, off the coast of North Carolina, where the Navy has operated EMPRESS II—which stands for EMP Radiation Environment Simulator for Ships—during the summer months since 1988, Osborne explained.

The oceangoing test facility is designed to simulate the EMP that accompanies a nuclear blast to study its effects on ships' electronics. While the Navy once planned ten cycles of testing per year—five at each site—it ran only two trials in each of the last two years at the Atlantic site and has only one scheduled for this year, according to Osborne.

Opponents of the proposed site, which is about 25 nautical

Finnish VDT–Pregnancy Study: EMF Risks at Lower Levels

In our last issue, we reported on a new Finnish epidemiological study showing that women using VDTs with strong magnetic fields had elevated rates of miscarriages.

Microwave News has now learned that the magnetic field levels specified in the Finnish report are "peak-to-peak" values, not the average or rms values to which most people refer. For VDT EMFs, dividing a peak-to-peak intensity by three yields the approximate rms value. Thus, the Finnish study points to an elevated miscarriage risk from exposures of about 3 mG or less.

miles south of the Mississippi and Alabama coastlines, are claiming victory, according to Mike Odom, a Montgomery, AL attorney who has led the local opposition to EMPRESS II. "We made it clear to the Navy that their environmental impact statement [EIS] was so inadequate that they risked a strong legal challenge." The Navy released a final EIS for the Gulf site in October 1991 (see *MWN*, M/J90 and J/F92).

If the Navy decides it wants to renew plans for the Gulf site, it will "comply with the requirements of [the National Environmental Policy Act], including public notification and interaction," according to a *Record of Decision* signed on March 24 by Elsie Munsell, deputy assistant secretary of the Navy for environment and safety. Had funds been available, Osborne said, "the questions concerning the project were, we feel, sufficiently answered to allow the program to go forward."

Separately, the Navy has settled a lawsuit brought in 1988 in an attempt to block the use of EMPRESS II at its Atlantic site. The plaintiffs, the Foundation on Economic Trends (FET), a Washington, DC-based think tank, and a regional planning commission in North Carolina, have agreed not to contest the site further. The plaintiffs' attorney, Lee Rogers of Rogers, Goxem and Krickenberger in Washington, said that interest had waned in North Carolina because the Navy moved the testing further offshore. The choice of the open-ocean site was itself a compromise after opposition forced the Navy to abandon plans to use EMPRESS II on Chesapeake Bay (see *MWN*, Oct84, Nov84, M/A87 and J/A87).

In March 1987, the FET sued the Department of Defense (DOD), seeking environmental review of existing EMP programs in all branches of the military (see *MWN*, M/A87). That suit was settled in May 1988 when the DOD agreed to shut down many of its EMP facilities, including an earlier Navy simulator known as EMPRESS I (see *MWN*, M/J88).

The 84-page *Record of Decision*, which supplements the EIS for the EMPRESS II Gulf Coast site, outlines issues raised in almost 200 letters that the Navy received. Both documents are available from: Lt. Commander Joseph Osborne, Naval Sea Systems Command (PMS-423), Department of the Navy, Washington, DC 20362, (703) 602-3348.

Gulf War EMP Weapon Reported

The U.S. Navy used a nonnuclear electromagnetic pulse (EMP) weapon on the first day of the Persian Gulf war to disrupt or destroy electronic defense and communications systems in Iraq, according to an article in the weekly trade publication *Defense News* (April 13-19). The article cites unnamed military and industry sources who describe a highly secret "black program" for development of the weapon. EMP warheads were carried on a few of the Navy's Tomahawk cruise missiles, the report states.

"It was worth doing simply because there was an opportunity," one industry expert told *Defense News*.

Neil Munro, who coauthored the piece with Robert Holzer, told *Microwave News*, "At first I didn't believe it, but enough people said it was true for me to write it."

It was difficult to judge the damage that the EMP warheads, a type of high-power microwave weapon, inflicted on Iraqi electronic equipment, since many other electronic countermeasures were also being used.

In the same issue of *Defense News*, Munro also reported on an Army program to develop high-power microwave devices for tanks as a mine-clearing tool. These weapons are designed to disable a mine's electronic circuitry. They are being developed by General Dynamics Corp. of Falls Church, VA.

Cellular Phone Suit *(continued from p.1)*

duration of her cellular phone use.

The Reynards' suit alleges that the phone had "an antenna so positioned as to cause exposure to microwave radiation in an excessive and unsafe amount to the portion of the brain where the tumor was found...." David Reynard is more specific. If an outline of the phone were superimposed on the MRI that showed his wife's tumor, the malignancy would be at the middle of the antenna, he told *Microwave News*. "It makes a perfect bull's-eye," he said.

NEC America is a subsidiary of NEC Corp. of Japan, and GTE Mobilnet of Tampa, which provided the Reynards' cellular service, is part of GTE Corp., based in Stamford, CT. Spokesmen for both companies said they would not comment on ongoing litigation. A third defendant, Coastal Radiotelephone Inc., sold the Reynards the cellular phone but is no longer in business.

Lloyd said the suit was prompted by the occurrence of other similar cancer cases in which users of cellular phones developed brain tumors. Lloyd said he and David Reynard know of three doctors in the Tampa Bay area who were heavy cellular phone users and who died from brain cancer.

The lawsuit is currently in discovery. Lloyd said the court allowed an expedited deposition to be taken from Susan Reynard because her health was deteriorating. He videotaped her testimony on April 24, covering the extent of her cellular usage and the history of her illness. "We had to get the suit started," Lloyd said. "I don't know how fast we'll move now."

The Reynards' complaint also alleges that "the cellular telephone did not meet accepted standards setting maximum levels of exposure to microwave radiation." In the U.S., the most widely cited guidelines for exposure to microwave radiation are the American National Standards Institute (ANSI) limits that were set in 1982 and recently revised (see *MWN*, N/D91). The standards have an exemption for devices with an input power of