## Two Views on EMFs and Cancer: At Most a Small Risk

Two new assessments of the cancer potential from electromagnetic fields (EMFs) have recently appeared in the *British Medical Journal (BMJ)* and in *Cancer*. (See also *MWN*, J/A88 for other reviews.)

In "Living Under Pylons: If Electromagnetic Fields Are Carcinogenic the Effect Is Weak," a commentary in the *BMJ*, (*297*, pp.804-805, October 1, 1988), Dr. Tar-Ching Aw of the U.K.'s University of Birmingham Institute of Occupational Health concludes that:

> If ELF EMFs do cause leukemia or other malignancies, then a general increase in these malignancies in the general population might be expected as the use of electric power for each head of the population increases. Also children with leukemia exposed to ELF fields might be expected to be younger than those without such exposure. Neither of these propositions seems to be true. At the most, the carcinogenic potential of ELF EMFs must be weak. It may be that as the wavelength of electromagnetic radiation lengthens and the frequency decreases, the carcinogenic effect diminishes.
>
> Further studies to evaluate the health hazards from ELF EMFs should take into account the complexities of measuring the strength of magnetic fields separately from that of electric fields. A comprehensive, relevant and valid method for assessing exposure is needed. Standards on limiting exposure to magnetic fields have been developed in several countries, and it would be useful to make these standards uniform by basing them on sound scientific data.

Dr. Roy E. Shore of New York University's Institute of Environmental Medicine in New York City presents a second perspective in "Electromagnetic Radiations and Cancer: Cause and Prevention," *Cancer*, (*62*, pp.1747-1754, October 15 Supplement, 1988). He writes:

> Although the studies provide a suggestive thread of evidence for an association between leukemia, especially acute myeloid leukemia, and exposure to EMFs, several caveats should be noted. None of the studies had adequate measures of EMF exposure levels for individuals, particularly measurements of the electrical fields, which are thought to be more biologically relevant than the magnetic fields. In the occupational studies, many of the electric occupations (*e.g.*, welders) would have had exposures to other potentially toxic agents as well. The occupational information on death certificates appears to be inaccurate or incomplete for 20% to 25% of deaths. Proportional mortality analyses, which were used in most of the occupational studies, may often contain hidden biases. Given these intrinsic methodologic problems and the questionable biologic plausibility of the relationship, it seems premature to conclude that exposure to EMFs causes leukemia based on the generally small elevations in risk that have been found, but the possibility cannot be ruled out. [references omitted]

Shore also addresses other types of ionizing and nonionizing radiation in his paper, which was accepted for publication on October 30, 1987, and first presented at an American Cancer Society conference in June 1987.

His review of radiofrequency and microwave radiation is brief, addressing only a few cellular and epidemiological studies. He concludes that, "It seems unlikely that microwave radiation is carcinogenic, but a longer follow-up of the Navy radar technician cohort could significantly strengthen the existing evidence." (Shore is referring to the 1980 Robinette-Silverman epidemiological study of Navy personnel.)

## NY State Considers a Second Power Lines Project

High-level negotiations are underway for a second New York State Power Lines Project (NYPLP-II) to investigate electromagnetic field (EMF) effects. Dr. David Carpenter, the dean of the New York State School of Public Health, who served as the executive secretary of the original NYPLP, has drawn up a list of research projects to be targeted by the NYPLP-II. Senior officials at the state's Public Service Commission (PSC) and at the Department of Health (DOH) are currently weighing his proposals.

On Carpenter's priority list are: a prospective childhood cancer epidemiological study with an assessment of exposures at home and at school; replications of two NYPLP studies—Dr. Kurt Salzinger's behavioral experiment and Dr. Richard Stevens's adult cancer study (taking into account new information regarding exposures from electrically heated beds); and an EMF–brain tumor study.

With more and more power line research being funded by the Electric Power Research Institute and by the U.S. Department of Energy, Carpenter is determined that, like the original project, the NYPLP-II be coordinated and run by a health-oriented state agency, such as the DOH. "I feel strongly that health hazards research should not be done exclusively by industry—it's the old problem of the fox guarding the chicken coop," he told *Microwave News* in an interview.

Who will pay for the four-to-five-year NYPLP-II is still unclear. New York state utilities footed the $5 million bill for the original project on the condition that they be exempt from funding future studies. Carpenter, however, believes that the utilities may decide that it is in their own best interests to support the NYPLP-II.

After the release of the NYPLP's final report in July 1987, New York State Commissioner of Health Dr. David Axelrod urged the National Cancer Institute (NCI) to follow up by sponsoring its own studies. The institute is planning a major study on the etiology of childhood cancer, which will include the possible role of magnetic fields (see *MWN*, M/A88). An NCI spokeswoman told *Microwave News* that a request for proposals for this study is in preparation. Otherwise, it seems that EMF effects are not a major health issue at NCI.

Carpenter said that he is somewhat dismayed by the NY PSC's interpretation of the NYPLP's final report—that the project's studies "revealed no evidence that magnetic fields pose a health hazard" (see *MWN*, M/A88). "Any logical person cannot conclude that there are no effects," he said. "It's

just wrong to imply that there are no hazards." He acknowledged that, for the moment, "it would be unrealistic to set the magnetic field limits at a few milligauss" because such a standard would alarm people and cause enormous dislocations.

## IEEE-PES and APPA Issue Statements on Health Effects

Two new position papers on electromagnetic field (EMF) effects have recently been issued.

The Biological Effects of Power Frequency EMFs Working Group of the IEEE's Power Engineering Society (PES) has released a short report prepared under the aegis of William Feero, the chairman of the working group. The report, which was written by a task force made up of Dr. Lee Rosen of W/L Associates in Frederick, MD, Jack Lee of the Bonneville Power Administration in Portland, OR, and Jack Sahl of Southern California Edison Co. in Rosemead, CA, is based on six recent health effects reviews, including those from the World Health Organization and from the New York State Power Lines Project. It concludes:

> At present there is no consensus expressed in the reports as to which factor, the electric or magnetic field, is the more biologically important. Similarly, the roles of field strength, duration of exposure, and intermittent versus continuous exposure are also unknown. This uncertainty complicates efforts to develop and implement methods of exposure mitigation. There is no clear direction concerning whether to reduce fields, and if so by how much, or whether harmonics are a factor. Therefore initiation of mitigation without an adequate scientific base may not be effective. EPRI is beginning to address the question of what is actual human exposure, with plans for a national program of magnetic fields measurements. It is expected, however, that such an effort will take years before useful information is available. It will take additional years for the biological sciences to determine what component, if any, of exposure is a factor in health risks.

Feero, who is with Electric Research & Management Inc. in State College, PA, told *Microwave News*, "The report is for the power engineer who has not been following this topic." It will be published in the December issue of the IEEE's *Power Engineering Review*.

Meanwhile, the American Public Power Association (APPA) has adopted resolutions calling for "increased and sustained funding for EMF health effects research on the part of individual electric utilities, EPRI, and the federal government," and stating its support for "efforts to provide timely, accurate, and complete information on EMF effects research to electric consumers and the general public."

The APPA has earmarked $50,000—from a total 1989 research budget of $500,000—for two studies on EMFs from buried power lines and on line configurations which generate lower EMFs. But despite the APPA's professed goals, APPA Director of Research Michael Bergman refused to offer any details on these projects. A summary of current and planned research should be available in early 1989.

# CONFERENCES

## 1989 Conference Calendar

January 29-February 3: **Winter Meeting of the IEEE Power Engineering Society,** Penta Hotel, New York, NY. Contact: IEEE Society Special Services, 345 East 47th St., New York, NY 10017, (212) 705-7895.

March 7-9: **8th International Zurich Symposium and Technical Exhibition on Electromagnetic Compatibility,** Zurich, Switzerland. Contact: Dr. T. Dvorak, ETH Zentrum-IKT, 8092 Zurich, Switzerland, (1) 256-2790.

March 10-12: **2nd Meeting of the International Society for Bioelectricity,** Sheraton Hotel, Denton, TX. Contact: Patricia Burnett, Dept. of Orthopaedic Surgery, LSU Medical Center, PO Box 33932, Shreveport, LA 71130, (318) 674-6170.

March 18-23: **37th Annual Meeting of the Radiation Research Society (RRS) and 9th Annual Meeting of the North American Hyperthermia Group,** Westin Hotel, Seattle, WA. Contact: RRS, 1101 Market St., 14th Floor, Philadelphia, PA 19107.

March 27-28: **15th Annual Northeast Bioengineering Conference,** Northeastern University, Boston, MA. Contact: Dr. Vinay Ingle, Department of Electrical and Computer Engineering, Northeastern University, 360 Huntington Ave., Boston, MA 02115, (617) 437-3008.

March 28-31: **INTERMAG '89 Conference,** Mayflower Hotel, Washington, DC. Contact: Diane Suiters, c/o Courtesy Associates, INTERMAG '89, 655 15th St., NW, Suite 300, Washington, DC 20005, (202) 639-5088.

March 29-30: **IEEE AESS National Radar Conference,** Sheraton Park Central Hotel, Dallas, TX. Contact: IEEE AESS Radar Conference, Attn: Russell Logan, PO Box 1000-262, McKinney, TX 75069.

April 2-7: **IEEE/PES Transmission and Distribution Conference and Exposition,** Convention Center, New Orleans, LA. Contact: Don Preston, Louisiana Power & Light Co., 317 Baronne St., PO Box 60340, New Orleans, LA 70160, (504) 595-2274.

April 4-7: **6th International Conference on Antennas and Propagation,** University of Warwick, U.K. Contact: Institution of Electrical Engineers, Savoy Place, London WC2R 0BL, U.K., (01) 240-1871, ext. 222.

April 5-6: **25th Annual Meeting of the National Council on Radiation Protection and Measurements (NCRP),** Vista International Hotel, Washington, DC. Contact: NCRP, Suite 800, 7910 Woodmont Ave., Bethesda, MD 20814, (301) 657-2652.

April 12-14: **5th Annual Meeting of the Electromagnetic Energy Policy Alliance (EEPA),** Radisson Mark Plaza Hotel, Alexandria, VA. Contact: Richard Ekfelt, EEPA, 1255 23rd St., NW, Suite 850, Washington, DC 20037, (202) 452-1070.

April 14-16: **Electrobiology Today: An International Symposium in Honor of Luigi Galvani,** Bologna, Italy. Contact: Organizing Secretariat, O.I.C., Via G. Modena, 19, 50121 Florence, Italy, (055) 57.78.22-57.10.82.

April 24-28: **International Conference on Radar,** Versailles, France. Contact: International Conference on Radar, 11 rue Hamelin, F-75783 Paris Cedex 16, France, (1) 45 05 71 69.

April 25-27: **IEEE Instrumentation and Measurement Technology Conference (IMTC)**, Washington, DC. Contact: Robert Myers, IMTC Conference Coordinator, 1700 Westwood Blvd., Suite 101, Los Angeles, CA 90024, (213) 475-4571.

April 29-May 2: **67th Annual Convention of the National Association of Broadcasters (NAB)**, Convention Center, Las Vegas, NV. Contact: NAB, 1771 N St., NW, Washington, DC 20036, (202) 429-5300.

April 30-May 3: **10th Annual Meeting of the Canadian Radiation Protection Association**, New Victoria Conference Center, Victoria, British Columbia, Canada. Contact: Lutz E. Moritz, TRIUMF, 4004 Wesbrook Mall, Vancouver, B.C. V6T 2A3, Canada, (604) 222-1047.

April 30-May 5: **6th Annual Magnetic Resonance Imaging National Symposium**, Hyatt Orlando, Disney World/EPCOT Center, FL. Contact: Florida Radiological Society, Program Committee, PO Box 17241, Tampa, FL 33682, (813) 873-2090 or (800) 338-5901.

May 7-12: **175th Meeting of the Electrochemical Society**, Los Angeles, CA. Contact: Electrochemical Society, 10 South Main St., Pennington, NJ 08534.

May 9-12: **2nd Dresden Symposium on Electrostimulation**, Dresden, G.D.R. Contact: Dr. K.-J. Schulze, Medical Academy "Carl Gustav Carus," Clinic of Orthopedics, Fetscherstrasse 74, Dresden, 8019 G.D.R.

May 13-17: **24th Annual Meeting and Exposition of the Association for the Advancement of Medical Instrumentation (AAMI)**, Cervantes Convention Center, St. Louis, MO. Contact: AAMI, 3330 Washington Blvd., Suite 400, Arlington, VA 22201, (800) 332-2264.

May 23-25: **IEEE National Symposium on Electromagnetic Compatibility**, Radisson Hotel, Denver, CO. Contact: Dave Hill, PO Box 4056, Englewood, CO 80155, (303) 497-3472.

May 31-June 2: **43rd Annual Frequency Control Symposium**, Denver Marriott City Center Hotel, Denver, CO. Contact: T.R. Meeker, 2956 Lindberg Ave., Allentown, PA 18103.

June 4-9: **International Symposium on Charge and Field Effects in Biosystems**, Virginia Commonwealth University (VCU), Richmond, VA. Contact: Jackie Elston, Conference Coordinator, College of Humanities & Sciences, Box 2019, VCU, Richmond, VA 23284, (804) 367-1674.

June 13-15: **1989 IEEE MTT-S International Microwave Symposium**, Long Beach, CA. Contact: Reynold Kagiwada, c/o LRW Associates, 1218 Balfour Dr., Arnold, MD 21012, (800) MICROWAVE.

June 18-22: **11th Annual Meeting of the Bioelectromagnetics Society (BEMS)**, Sheraton El Conquistador Conference Center, Tucson, AZ. Contact: Dr. W.G. Wisecup, BEMS, 120 West Church St., Frederick, MD 21701, (301) 663-4252.

June 25-29: **34th Annual Meeting of the Health Physics Society (HPS)**, Albuquerque, NM. Contact: HPS, 8000 Westpark Dr., Suite 400, McLean, VA 22102, (703) 790-1745.

June 26-29: **14th Annual Conference of the Australian Radiation Protection Society**, Perth, Western Australia. Contact: ARPS-14 Conference Convenor, c/o Radiation Protection Office, Queen Elizabeth II Medical Centre, Verdun St., Nedlands, 6009, Western Australia, Australia, (09) 389 2262.

June 26-30: **IEEE AP-S International Symposium & URSI Radio Science Meeting**, Red Lion Inn, San Jose, CA. Contact: Dr. Ray King, General Chairman, Lawrence Livermore National Laboratory, L-156, Livermore, CA 94550, (415) 423-2369.

July 9-14: **1989 IEEE PES Summer Meeting**, Hyatt Regency, Long Beach, CA. Contact: IEEE Society Special Services, 345 E. 47th St., New York, NY 10017.

July 24-27: **1989 SBMO International Microwave Symposium**, Maksoud Plaza, São Paulo, Brazil. Contact: Dr. Octavio Andrade, IMT–Escola de Engenharia Mauá, Estrada da Lágrimas, 2035, 09580 - S. Caetano do Sul - São Paulo, Brazil, (011) 442-6944.

August 1-3: **4th International EMC EXPO-89**, Sheraton Hotel, Washington, DC. Contact: Jeff Eckert, PO Box D, State Route 625, Gainesville, VA 22065, (703) 347-0030.

August 7-11: **Non-Ionizing Radiations: Biophysical and Biological Basis, Applications and Hazards in Industry and Medicine**, Massachusetts Institute of Technology (MIT), Cambridge, MA. Contact: Director of Summer Sessions, Room E19-356, MIT, Cambridge, MA 02139.

August 22-25: **International Symposium on Antennas and Propagation**, Tokyo, Japan. Contact: Dr. Takashi Katagi, Mitsubishi Electric Corp., 325 Kamimachiya, Kamakura, 247 Japan, (0467) 44-8862.

August 28-September 1: **6th International Symposium on High Voltage Engineering**, Westin Canal Place Hotel, New Orleans, LA. Contact: Professor P.B. Jacob, Electrical Engineering Dept., Mississippi State University, PO Drawer EE, Mississippi State, MS 39762, (601) 325-3912.

August 29-September 1: **2nd International Symposium on Antennas and EM Theory**, Shanghai, People's Republic of China (PRC). Contact: Professor Mao Yukuan, Xidian University, 2 Taibe Rd., Xi'an, PRC.

September 4-8: **2nd International Conference & Workshop on Electromagnetic Interference & Compatibility (INCEMIC)**, Bangalore, India. Contact: Dr. G.K. Deb, Electronics and Radar Development Establishment, C V Raman Nagar, Bangalore - 560 093, India.

September 4-8: **2nd International Symposium on Recent Advances in Microwave Technology**, Beijing, People's Republic of China. Contact: Dr. Banmali Rawat, Dept. of Electrical Engineering/Computer Science, University of Nevada, Reno, NV 89557, (702) 784-6927.

September 8-10: **International Symposium on Electromagnetic Compatibility**, Trade and Industry Center, Nagoya, Japan. Contact: Professor Y. Miyazaki, Toyohashi University of Technology, Toyohashi, 440 Japan, (0532) 47-0111, ext. 576.

September 11-14: **Work with Display Units 89 (WWDU89)**, Queen Elizabeth Hotel, Montréal, Québec, Canada. Contact: WWDU89, Institut de Recherche en Santé et en Sécurité du Travail du Québec, 505 boul. de Maisonneuve Ouest, Montréal, Québec H3A 3C2, Canada, (514) 288-1551.

September 17-20: **9th Annual Meeting of the Bioelectrical Repair and Growth Society (BRAGS)**, Cleveland Clinic Hotel, Cleveland, OH. Contact: Executive Secretary, BRAGS, PO Box 64, Dresher, PA 19025.

September 21-23: **10th Conference of the European Society for Hyperthermic Oncology**, Amsterdam, The Netherlands. Contact: Congress Office, Bureau PAOG–10th ESHO, Tafelbergweg 25, 1105 BC Amsterdam, The Netherlands, (20) 566-4801.

September 24-30: **10th International Conference on Bioelectrochemistry and Bioenergetics (BEC X)**, Centre Culturel des Prémontrès, Pont-à-Mousson, France. Contact: Prof. René Buvet, BEC X, 23, allée de la Toison d'Or, F.94000 Créteil, France; or (in the U.S.) Martin Blank, College of Physicians and Surgeons, Columbia University, 630 W. 168th St., New York, NY 10032, (212) 305-3644.

September 26-28: **11th Annual Electrical Overstress/Electrostatic Discharge Symposium**, Hyatt Regency, New Orleans, LA. Contact: Bob Rountree, Texas Instruments Inc., 12201 Southwest Freeway, MS 631, Houston, TX 77001, (713) 274-2067.

September 26-28: **International Conference on Lightning and Static Electricity**, University of Bath, U.K. Contact: Laura Christie, Principal Conference Organizer, ERA Technology, Ltd., Cleeve Rd., Leatherhead, Surrey KT22 7SA, U.K.

September 26-29: **International Conference on High Frequency/Microwave Processing and Heating**, Arnhem, The Netherlands. Contact: KEMA, PO Box 9035, 6800 ET Arnhem, The Netherlands.

# UPDATES

## BIOLOGICAL EFFECTS

**USAF's Search for Mechanisms...**Dr. David Erwin of the USAF's School of Aerospace Medicine (USAFSAM) presents "an overview of present knowledge" of the mechanisms of interaction of RF/MW radiation with tissues, with special emphasis on the USAFSAM's own research. Erwin stresses thermal responses; he devotes only two paragraphs to non-thermal effects. His review appears in the November 1988 issue of *Aviation, Space, and Environmental Medicine, 59,* pp.A21-31, a supplement to issue No.11.

**Call for Papers...**Dr. Harry Brown, the editor of *Cancer Biochemistry Biophysics,* is inviting researchers investigating the link between EMF effects and cancer to submit manuscripts to the journal. "Our intent is that we become a major publication in this subdiscipline," according to Brown. He is planning to increase the frequency of publication, which is now quarterly, and to speed up the printing schedule—the time between a paper's submission and its publication. He is interested in both original studies and review articles. Brown himself recently wrote a major review on EMFs and cancer (see *MWN*, J/A88). For more information, contact Brown at: Biochemistry Department, Cook College, Rutgers University, New Brunswick, NJ 08903, (201) 932-9728.

## COMPATIBILITY & INTERFERENCE

**NIST on Cable Shielding...**The NIST is developing guidelines to evaluate the shielding effectiveness of cables and connectors against EMI from pulsed radiation with fast rise times and high-frequency components, such as from high-power microwaves (HPM), as well as from lightning and EMP. According to NIST's Myron Crawford, cables are the most likely electronic component to pick up electromagnetic energy, leading to EMI. When asked whether improperly shielded cables may have contributed to EMI-induced helicopter crashes (see Military Applications on p.13), he replied, "It's a possibility." The NIST, formerly known as the NBS, can determine the shielding effectiveness of cables from 14 kHz to 18 GHz with dynamic ranges up to 130 dB. Staff engineers have already examined the cables beyond the RF barrier in the payload bay of the space shuttle for Martin Marietta and tests of other aerospace systems are planned. Crawford said that while the NIST develops methods for testing cables, solutions are the client's responsibility. For more information, contact: Myron Crawford, Division 723.03, NIST, Boulder, CO 80303, (303) 497-5497.

**TEMPEST Market...**Sales of TEMPEST products continue to grow, albeit at a slower pace than predicted last year. According to Frost & Sullivan (F&S), the market will expand from $1.01 billion in 1987 to over $2 billion in 1993—considerably less than the $2.9 billion by 1992 predicted in a similar report issued last year (see *MWN*, S/O87). A spokeswoman for F&S said that there have been many changes in the industry, which, in fact, prompted the early revision of the report. F&S estimates that the largest segment of the market is for TEMPEST-rated personal computers: $253 million in 1987, which is expected to grow to $389 million by 1993. *The U.S. Military TEMPEST Equipment Market* (No.A1956) is available for $2,150 from: F&S, 106 Fulton St., New York, NY 10038, (212) 233-1080.

## GOVERNMENT

**CDRH Publications Guide...**The FDA's Center for Devices and Radiological Health (CDRH) has released a *Publications Index,* which lists medical device and radiological health documents published by the center and/or authored by its staff from 1978 through 1986. The 240-page catalogue, which is indexed by title keywords, author and accession number, includes scientific journal articles, published abstracts and technical reports. The center plans to update the index every other year. A copy is available for $28.95, plus a $3.00 handling charge, from: National Technical Information Service (NTIS), 5285 Port Royal Rd., Springfield, VA 22161. Specify NTIS Accession No.PB89120372/AS.

## MEDICAL APPLICATIONS

**New PEMF Treatments...**Two new reports published in consecutive issues of *The Lancet* confirm the benefits of treating localized circulatory problems and muscle atrophy due to immobilization with PEMFs. In the September 24 issue, researchers at the Karolinska Institute in Stockholm, Sweden, report that breast reconstruction patients, who were treated locally with 80 Hz square pulses with a duration of 0.4 msec, experienced an increase in localized blood flow. The researchers conclude that their study and others indicate that electrical nerve stimulation "should be tried in ischaemic surgical flaps and possibly other ischaemic skin conditions such as leg ulcers."...And according to a report in the October 1 issue by a research team from the Universities of Edinburgh and Dundee in Scotland, U.K., led by Dr. J.N.A. Gibson, electrical stimulation prevented muscle atrophy in immobilized thigh muscles. Seven patients in casts for fractured tibias were given muscle stimulators generating 30 Hz square wave pulses on a 2 sec on–9 sec off cycle and designed to be used one hour a day at home. After six weeks, their injured and healthy legs showed similar levels of muscle mass and rates of muscle protein synthesis. Patients who did not use the stimulators showed evidence of muscle wasting in their immobilized legs. See also a letter in the October 29 *Lancet* prompted by Gibson's report.

**SAD Society in the Works...**A group of researchers who share an interest in visible light therapy and circadian rhythms are banding together to form the *Society for Light Treatment and Biological Rhythms.* Although still in the planning stages, the organization already includes psychiatrists, psychologists and physiologists. Many of the members do research on

seasonal affective disorder (SAD)—a winter depression caused by deprivation of natural light—while others focus on therapies for sleep disorders and for controlling biorhythms among night shift workers and jet lag sufferers. According to founding member Dr. Michael Terman of the New York Psychiatric Institute in New York City, the group hopes to put out a newsletter covering current research and general society news. An electronic mail linkup and a press liaison for publicizing new developments are also being considered. For more information, contact: Dr. Michael Terman, NY Psychiatric Institute, 722 West 168th Street, Box 50, New York, NY 10032, (212) 960-2200.

**Measuring Bioelectric Currents...**Researchers at Arizona State University in Tempe have developed a non-invasive method to measure low-level bioelectric currents in small animals. In a paper published in the October issue of *IEEE Transactions on Biomedical Engineering*, Drs. Bruce Towe and Mohammed Rezaul Islam make use of the Lorentz forces generated by the current flowing through biological media exposed to magnetic fields to trigger acoustic vibrations detectable by a microphone. Towe and Islam believe that their method is cheaper and easier than the SQUID. At this point, however, it is unclear whether their technique—which worked successfully on hamsters—can be extended to humans.

## MEETINGS

**Bioelectromagnetics in Italy...**An international symposium on *Electrobiology Today* will be held in Bologna, Italy, April 14-16. The meeting is in honor of Luigi Galvani (1737-1798), the famed anatomist whose experiments with frogs opened up the study of animal electricity. Galvani was born and died in Bologna. The meeting will be divided into three parts—biophysics, biology and clinical orthopedics—and promises to have an international cast of researchers. See the 1989 conference calendar on p.10 for contact address....The following month, May 10-19, a short course will be held in Erice, Sicily, on *Optical Sources, Lasers and Synchrotron Radiation: Biological Effects and Hazard Potential.* The course will focus on risks to the eyes and the skin. The National Science Foundation has some travel funds available for a limited number of U.S. students. For more information on the course and travel grants, contact: Dr. David Sliney, U.S. Army Environmental Hygiene Agency, HSHB-MR-LL, Aberdeen Proving Ground, MD 21010; or Dr. Martino Grandolfo, National Institute of Health, Physics Laboratory, Viale Regina Elena, 299, 00161 Rome, Italy.

**BRAGS Proceedings...**The *8th Annual Meeting of the Bioelectrical Repair and Growth Society* (BRAGS) was held in Washington, DC, October 9-12. A copy of the *Transactions*, which includes abstracts of the 69 papers and posters presented at the meeting, as well as a directory of the society's membership, is available for $45.00 (including postage) from: Executive Secretary, BRAGS, PO Box 64, Dresher, PA 19025.

## MILITARY APPLICATIONS

**Black Hawk EMI Update...**"EMI does raise safety of flight concerns with respect to the Black Hawk" helicopter, Michael Stone, under secretary of the Army, acknowledged in a September 2 memorandum to the DOD Inspector General (see *MWN*, S/O88). On September 30, the Army submitted plans for EMI shielding modifications for the Black Hawk to the U.S. Senate Appropriations Committee's subcommittee on defense. J.R. Sculley, assistant secretary of the Army, told the subcommittee that the total projected cost for shielding existing and future Black Hawks is $175,000,000—$72,000 for each new helicopter and $84,000 for each old one. The shielding program, which is already underway, is expected to be completed by 1992. Earlier, the Army had considered plans to employ the same EMI protection specifications—up to 200 V/m—as those used by the U.S. Navy for shielding its Sea Hawk helicopter; the estimated cost was $450,000,000.

## OVENS

**Heating Applications...**A MW dryer which reportedly dries laundry 30% faster than a conventional model may soon be on the market. The "Miracle Dry," manufactured by Micro Dry Inc. of Tulsa, OK, uses less energy, needs no special air vents and can be plugged into any wall socket, according to the September issue of *High Technology Business*. Micro Dry also claims that its product can kill bacteria in fabric. But two researchers at the Associated Sciences Research Foundation in Marlborough, NH, warn that heating cotton underpants in a MW oven to destroy the fungus responsible for yeast infections may cause them to catch fire, reports the latest issue of IMPI's *Microwave World*....Gerling Laboratories has issued a newly expanded sales catalogue of industrial MW components and systems operating at the ISM frequency of 2.45 GHz. To order a copy, contact: Gerling Labs, 1132 Doker Dr., Unit 1, Modesto, CA 95351, (209) 521-6549....Chemists looking for a way to accelerate chemical reactions might try a MW oven. According to a feature story in the *New Scientist* (November 12), heating with MWs can speed up some organic reactions by a thousand times or more.

**Notes on "Microwaving"...**Cooking fish in a MW oven may be the best way to preserve omega-3 fatty acids, which are increasingly believed to lower cholesterol and help prevent heart disease. According to an article in the *Wall Street Journal* (November 7), a University of Massachusetts food scientist claims that, although cooking in high temperatures can remove up to one half the omega-3, microwaving does not alter the oil content....Libraries may no longer have to resort to expensive methods to fumigate their books. *Science News* (October 29) reports that a Syracuse, NY, researcher suggests tossing the books in the MW for a minute to get rid of insects.

# UPDATES

## PEOPLE

Professor **Ted Grant** and Dr. **Camelia Gabriel** are branching out from the ivory tower—they have formed "University Microwave" to provide dielectric measurements services and to advise U.K. industry on RF and MW safety. They will both retain their positions at the University of London's King's College....**Lynn Claudy**, formerly with Hoppman Corporation in Chantilly, VA, has joined the National Association of Broadcasters as a staff engineer. He is also an adjunct professor of physics at The American University in Washington, DC....Dr. **Tom Rozzell**, the founding editor of the *Bioelectromagnetics Society Newsletter*, has stepped down. Rozzell has been editing the newsletter since 1978. The society's board of directors is expected to announce a permanent replacement soon....**James Hill**, president of EMXX Corp. and a founder of the IEEE's EMC society, died on October 30 at his home in Ohio.

## STANDARDS

**ISM Rules...**CISPR has released a six-month draft rule revising its Publication 11, *Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical (ISM) Radiofrequency Equipment (Excluding Surgical Diathermy Apparatus)*, CISPR/B(Central Office) 23. A copy is available for $45.00 from: International Sales Department, ANSI, 1430 Broadway, New York, NY 10018. ...In 1987, the Hong Kong Telecommunications Authority released regulations on *Radio Interference Limits and Methods of Measurements for ISM RF Equipment*, excluding surgical diathermy units and RF welding machines. For a copy of the standard, which is scheduled to be adopted in December 1988, contact: Office of Standards Code and Information, Administration Bldg., Room A629, NIST, Gaithersburg, MD 20899, (301) 975-4037. Specify TBT/notif.88.198.

## TECHNOLOGY

**Holding Pattern for MLS...**The Federal Aviation Administration (FAA) is backing a 17-month study on the microwave landing system (MLS). The proposed study is part of a three-year FAA program designed to address airline pilot and operations personnel concerns about the need for and the capabilities of the MLS, according to *Aviation Week and Space Technology* (October 10). These actions follow the General Accounting Office's (GAO) recommendation that the FAA halt plans for purchasing additional MLSs until their potential operational and economic benefits have been adequately demonstrated. The MLS was originally intended to replace the Instrument Landing System (ILS), which, like the MLS, helps aircraft land in conditions of limited visibility. Designed to increase airport capacity and reduce flight delays, the MLS was selected to become the primary system for military and civilian use amid concerns over the ILS's reliability. Developmental problems, however, have delayed the installation of MLSs, while ILS capabilities have been updated and improved. The FAA has asked Congress to appropriate over $1 billion for MLS conversions, but, in its May 1988 report to the House subcommittee on transportation, the GAO concludes that the FAA has not adequately demonstrated the need for the MLS. (Congress turned down FAA requests for MLS funding in FY87 and FY88 pending operational tests and a strategy review.) For its part, the Air Transport Association (ATA), which represents 21 U.S. airlines, opposes the costly MLS, although ATA officials have acknowledged that ILS limitations—particularly, FM radio band interference on the ILS frequency—may ultimately force its members to accept the MLS. In the meantime, the GAO recommends reserving previously purchased MLSs for airports where ILSs cannot be used and for operational testing, while retaining the ILS as the primary landing system in the U.S. For a copy of the GAO report (No.GAO/RCED-88-118), contact: U.S. General Accounting Office, PO Box 6015, Gaithersburg, MD 20877, (202) 275-6241. Single copies are available free of charge.

**Traveling Light...**The worldwide market for photonics—the use of visible light to gather, process and transmit information—is growing by leaps and bounds, according to a research panel of the National Research Council. In its report, *Photonics: Maintaining Competitiveness in the Information Era*, the panel states that systems powered by photons are faster, more resistant to EMI and have a larger information-carrying capacity than those powered by electrons. Possible applications include telecommunications, computer networks, optical sensors for robots and advanced imaging equipment. A copy of the council report is available for $11.95, prepaid, from: National Academy Press, 2101 Constitution Ave., NW, Washington, DC 20418, (202) 334-3313.

## VDTs

**Radiation Q's & A's...**A new booklet covering the basics of what is known about VDT radiation has been prepared by David Charron of the Canadian Centre for Occupational Health and Safety (CCOHS). The 11-page report, *Health Hazards of Radiation from Video Display Terminals: Questions and Answers* (P88-15E), was released in July 1988 and is available in French and in English from: CCOHS, 250 Main St. East, Hamilton, Ontario L8N 1H6, Canada, (416) 572-2981. Single copies are free for Canadians and cost $3.00 (U.S.) for all others.

## ETC...

**Will Microwaveland Be Next?...**A Maine resident who challenged a state law prohibiting the alteration of license plates won the right to change his plate to read "Radiationland," instead of "Vacationland," as an expression of his opinion of nuclear energy, according to the October 16 *New York Times*.

## RTCA on Electronic Devices Aboard Aircraft *(continued from p.1)*

from electronic devices used aboard aircraft is "small" because a number of unlikely conditions must be present to cause a disruption. Frank White, the chairman of the RTCA committee, does not think there is much of a risk: "Some years ago, I offered $1,000 of my own money to any passenger carrying an electronic device who could cause it to interfere and no one has yet collected."

Nevertheless, the risk was deemed great enough for the RTCA to seek certain limits on the use of computers and radios aboard aircraft. As White told *Microwave News*, "You have got to play it smart and restrict their use during takeoffs and landings." With respect to intentional radiators such as cellular phones and remote-controlled toys, the committee recommends that they never be operated aboard aircraft. As far as computers are concerned, White said that limiting their use makes sense because the portables are just like tray tables and should be stowed during takeoffs and landings.

### No In-Flight FM Radio Use

According to White, of all unintentional radiators, FM receivers present the greatest risk of EMI. "If I were making FM radios, I would label them 'not for use aboard aircraft,' " he said. "Computers are less of a problem now, but that could change as their clock frequencies rise." He explained that the majority of an aircraft's communication and navigation systems operate above 100 MHz—specifically in the 108-136 MHz band; thus the interfering signal would have to come from a computer's fifth-or-higher harmonic, which is usually too weak to cause EMI. "In any case," White said, "it would cost less than 25 cents to detune any circuits that cause resonances and emit powerful harmonics."

A probabilistic analysis included in the RTCA report estimates the chance of interference with a Boeing 727's instrument landing system (ILS) localizer is less than one in a million. The FAA ran on-the-ground and in-flight tests with an FM radio on a 727; even when the radio was placed next to a window, where there is the least attenuation, and when all other conditions believed to be necessary to cause EMI were met, there was no interference with the ILS.

The report suggests that the FCC require that devices rated for use aboard aircraft meet Class B limits for electric field radiated noise and the German VDE (Verband Deutscher Elektrotechniker) limits for magnetic field noise—no similar U.S. standard now exists. White admitted that he is doubtful that the FCC would act quickly on this recommendation because the commission is already in the midst of revising its Part 15 rules. "The probability of a new category in the next year or two is extremely small," he said.

The two-volume report, *Potential Interference to Aircraft Electronic Equipment from Devices Carried Aboard*, is full of test data and EMI incident reports. One appendix lists 29 such cases, of which 19 were instances of suspected interference to OMEGA receivers which came to the attention of the U.K. Civil Aviation Authority; six involved VOR, ILS and glide slope. The RTCA committee notes that after the manufacturer improved a particular type of OMEGA receiver, no more incidents were reported.

White stressed that manufacturers of computer and other portable electronic devices cooperated with his committee and were most helpful in the preparation of the RTCA report.

## ELF-Fetal Loss Link *(continued from p.1)*

a physicist, runs Monitor Industries in Boulder, CO.

In homes with cable heating, Wertheimer and Leeper estimated—through measurements and calculations—the magnetic and electric fields to be approximately 10 mG and 10-50 V/m, respectively, when the heat was on. Electrically heated beds generate magnetic and electric fields of up to 15 mG and 250 V/m. In most houses, the ambient fields are, respectively, less than 1 mG and about 10 V/m.

As in their electric blanket study, Wertheimer and Leeper compared seasonal variations in miscarriage rates in one group of women—rather than compare two different groups—to control for possible confounding variables, such as smoking, age and socioeconomic status. They found the greatest fetal loss during months when the weather became increasingly colder and the use of electrical heat was on the rise.

The key to Wertheimer and Leeper's analysis is that the highest rate of fetal loss was observed *not* in the coldest months, when EMF exposure from electric heating is highest, but, rather, in the progressively colder months when EMF exposure is increasing. According to their hypothesis, strong EMFs cause the "silent" death of the fetus—silent because both the pregnancy and the loss go unrecognized by the mother. The "recognized" loss occurs when the fetus has undergone some development prior to the EMF exposure; the fetus survives the earliest stages of the pregnancy only to be miscarried when the exposure reaches a higher level.

The ratio of recognized fetal loss among women in cable heated homes to that among women living in houses with other types of heating was found to be greatest during increasingly colder months and lower when temperatures climbed. These two trends averaged out so that, for both groups, the proportion of birth records with a reported fetal loss was approximately the same.

The cable heating study was based on birth records from Eugene and Springfield, OR, for 1983 and 1985. Wertheimer and Leeper investigated fetal losses that occurred within a year prior to conception of a liveborn infant, because fetal losses that "occur so near a successful pregnancy are usually spontaneous...rather than induced...."

Wertheimer and Leeper are best known for their landmark 1979 study which showed that children living in homes near high current power lines had a higher rate of cancer than those living in homes away from such lines. Their electric blanket study appeared in *Bioelectromagnetics*, 7, pp.13-22, 1986.

# CLASSIFIEDS


***ORDER YOUR OWN SET OF MICROWAVE NEWS 1988***

The Complete Six-Issue Set
Is Only $95.00
($100.00 Canada & Foreign),
a savings of $155.00!

Prepayment Required

**To order *MWN '88*, write to:**

*Microwave News*
PO Box 1799,
Grand Central Station,
New York, NY 10163,
(212) 517-2800.

RICHARD TELL ASSOCIATES, INC.

**RADIOFREQUENCY RADIATION and POWER FREQUENCY FIELDS CONSULTING SERVICES**

- RF Radiation Hazard Measurements
- Electric Power Transmission Studies
- Environmental and Industrial Evaluations
- Training Seminars

RICHARD A. TELL, PRESIDENT

702-645-3338 • 6141 W. RACEL ST., LAS VEGAS, NV 89131

***VDT NEWS***

"Recognized for its authority on
health and safety issues"
— *Fortune* Magazine

1-year subscription (6 bimonthly issues) for
$87.00 ($97.00 Canada & Foreign).

Order from: *VDT News*, PO Box 1799, Grand Central Station, New York, NY 10163, (212) 517-2802.

**The Bioelectromagnetics Society**
**is looking for a few good members**

**BEMS**

is the only scientific society that deals exclusively with bioelectromagnetics research and questions related to biological effects and uses of electromagnetic energy.

**Membership is open to all scientists and engineers with an interest in the field.**

***For more information on membership, the Journal, the Newsletter, and other activities of the Society, write to:***

**BEMS**
**120 W. Church Street**
**Frederick, MD 21701**
**(301) 663-4252**

**Order Microwave News**

[ ] 1-year subscription (6 bimonthly issues)
for $250.00 ($285.00 Canada & Foreign).

[ ] 6-month trial (3 bimonthly issues)
for $130.00 ($150.00 Canada & Foreign).

[ ] ____ back issues, 1981-1988,
$95.00 per year ($100.00 Canada & Foreign).

Order from: *Microwave News*, PO Box 1799,
Grand Central Station, New York, NY 10163,
(212) 517-2800.
[U.S. Funds Please]

Name_____
Institution_____
Address_____
City_____
State_____Zip_____

MICRO WAVE NEWS

Vol. IX No. 6 A Report on Non-Ionizing Radiation November/December 1989

INSIDE...

ELF NEWS pp.2-9

Power Line Talk:
EMFs on TV & in Print • Congressional Indifference • BC Hydro's New Battle • CU on Electric Blankets • COMAR Responds to Brodeur • Physicists' Skepticism • Foster Now Favors Research
EPRI Withdraws From Annual DOE Review
EMFs in the Popular Press
Ongoing Cancer Epidemiological Studies
Savitz Links Brain Cancer to EMFs
Colorado Favors "Prudent Avoidance"
Florida Teachers To Wear EMF Meters
California Calls EMF Rules "Premature"
Matanoski, EPRI and the Media
Telephone Linemen Risk Table

HIGHLIGHTS pp.9-11

IBM Markets Low VLF Radiation VDTs
Leukemia Linked to Chronic MW Exposure
RF Radiation Compliance Issues
BENER Digest To End
FAA Ranks EMI Protection as High Priority
NIER in Nordic Countries

FROM THE FIELD p.15

Swedish Academy of Sciences on Low-Level EMF Mechanisms of Interaction

UPDATES pp.13-14

More on PAVE PAWS and EEDs • People in the News • Bioelectromagnetic Association Launched in Europe • McDonald's Fights EMI • Power Lines No Hazard to EEDs • KGB's Low Frequency Signal • Membranes and Cancer Proceedings • Baby Crib Party Line • Recent Papers • and more....

CONFERENCES pp.12-13

1990 Conference Calendar

# Telephone Linemen Study Boosts Cancer Promotion Hypothesis

Cable splicers, a subgroup of telephone linemen, had significantly elevated rates of all cancers, especially leukemia, according to preliminary results of an ongoing epidemiological study at Johns Hopkins University (JHU). The splicers also had higher than expected rates of lymphoma and lung, prostate and colon cancer. The incidence of leukemia was seven times that of other workers in the telephone company; the rate of prostate cancer was more than four times higher.

Drs. Genevieve Matanoski, Elizabeth Elliott and Patrick Breysse of JHU's School of Hygiene and Public Health in Baltimore, MD, concluded that their "remarkable" results "are in keeping with a hypothesis of cancer promotion from electromagnetic field (EMF) exposure."

Measurements of on-the-job exposures indicate that the splicers had surprisingly low-level EMF exposures—a mean level of 4.3 mG.

Matanoski and Breysse announced their findings at the annual review of power line research, held in Portland, OR, November 13-16. In an interview, Matanoski said that she herself had been "surprised" by her results

## *Cancer Epidemiological Studies Worldwide*

*More than 22 major epidemiological studies of the potential link between EMFs and cancer are now under way in 12 countries. See pp.4-5 for a* Microwave News *special report.*

—as were most of the attendees.

These new findings come from a survey of cancer among 50,582 young linemen at New York Telephone Company from 1976 to 1980. The study is an offshoot of an ongoing national epidemiological study of telephone workers who died of leukemia (see table on p.5). Most of the leukemia deaths were among older, retired workers. Matanoski initiated the second study to test the question: "Do *young* workers have an increased risk of leukemia associated with [EMF] exposure?" (The median age of the linemen in the New York study was approximately 40.)

At last year's review, Matanoski reported that, based on preliminary data, there was no evidence of an increased risk of leukemia in her national mortality survey (see *MWN*, N/D88). The team is still analyzing these data.

### A Possible Breast Cancer Cluster

Matanoski found two cases of breast cancer among the 9,561 central office male technicians surveyed. In addition, she said that there may have been up to four more cases of breast cancer among the New York linemen.

*(continued on p.8)*

## « Power Line Talk »

The EMF threat was a pervasive theme on television news shows coast-to-coast in November. In Los Angeles, KNBC headlined its three-day report ***Wired to Kill?***; New York City's WNBC featured a variation—***Power to Kill?*** On Chicago's WMAQ, the headline was ***Trouble Overhead***, while Philadelphia's WCAU warned of ***A Current Danger***. NBC's Bryant Gumbel interviewed Paul Brodeur on the November 28 "Today Show" in a segment titled ***Electric Shock***. And in September, Montreal's CFCF-TV focused on VDTs with a four-part report on ***Computers and the Unborn***.

«« »»

Even **Johnny Carson** is talking about EMFs. On October 26, America's favorite television talk show host offered his fans a look at the lighter side: "I saw a funny item in the paper. If you use an electric blanket for a prolonged period, it could cause cancer. There goes the last safe bedtime thrill."

«« »»

DOE's **Ken Klein** told KNBC that it would cost the U.S. approximately **$5 billion a year**, every year for 20 years, to address the EMF problem.

«« »»

All the publicity about EMFs has caused hardly a stir in the **U.S. Congress**. At the Senate Committee on Governmental Affairs, chaired by John Glenn (D-OH), investigators have been looking into the issue. But just when it appeared that a hearing would be scheduled, staff turnover put EMFs on the back burner. Any action has been put off for now.... Congressman Frank Pallone (D-NJ) may get involved—his constituents are fighting a 230 kV power line proposed by Jersey Central Power & Light (see *MWN*, J/A89). He is drafting legislation which would set aside funding for the type of research recommended in the Congressional Office of Technology Assessment (OTA) report.

«« »»

In the absence of an agreed-upon mechanism of interaction, physicists continue to be highly skeptical that EMFs play a role in cancer development. In an opinion piece published in *Newsday* (October 29) and reprinted in other newspapers, Dr. **Robert Park**, the director of the Washington, DC, office of the **American Physical Society** (APS), asserted that, "There is, however, virtually no laboratory evidence of harmful effects from ELF and no known biological response to such fields that would lead one to expect harmful effects." Given that many such studies have in fact been published, we asked Park about the apparent inconsistency. "Some of this work is very strange," he replied. "It is not surprising that you find people that report some kind of an effect." Park also drew a distinction between an "effect" and a "hazard." For instance, he said, we all respond to the smell of freshly baked bread, but it does not pose any risk. The APS Panel on Public Affairs is considering whether to issue a report on EMFs: "An informal subcommittee is looking into whether the APS can make a contribution," Park said.

«« »»

Critiques of **Paul Brodeur's** *New Yorker* series and of his newly published book, *Currents of Death*, are piling up. The latest—and the harshest—comes from the IEEE's Committee on Man and Radiation (**COMAR**), which characterizes Brodeur's writings as "an extremely biased assessment of the existing facts and scientific data." The COMAR members, whose comments were gathered by Dr. **Eleanor Adair** of the John Pierce Foundation in New Haven, CT, "believe that environmental issues are too important to be allowed to become,

### EPRI Withdraws from Annual DOE Bioeffects Review

The Electric Power Research Institute (EPRI) has withdrawn its support for the annual review of research on the biological effects of power line electromagnetic fields (EMFs). The U.S. Department of Energy will continue to sponsor the meeting on its own.

At the opening session of the November meeting in Portland, OR, Dr. Leonard Sagan, the manager of EPRI's radiation program, said, "It's time to move on, for better or worse." Sagan cited the growing technical nature of the presentations and said that those doing contract research for EPRI will now be asked to present their data at the annual meeting of the Bioelectromagnetics Society.

DOE's Dr. Imre Gyuk, who spoke next, said that the meetings certainly will go on without EPRI.

Many of the attendees at the Portland review were disappointed. "There is an advantage to joint meetings," said a utility engineer with EMF responsibility. Others pointed out that the annual meeting is the only conference devoted solely to power line EMFs and that, in the ten years since the meetings began, they have provided a unique forum in which to exchange ideas. The fact that the meetings have no registration fee has no doubt also contributed to their success.

In an interview, EPRI's Dr. Charles Rafferty told *Microwave News* that EPRI contractors will be allowed, but not required, to attend the DOE annual reviews.

as characterized by Dr. **Asher Sheppard**, 'a part of the media circus in which the public is alternately scared to death and then passivated.' " (A dozen years ago, COMAR issued a detailed analysis of Brodeur's *The Zapping of America*.)

«« »»

There is little doubt that the EMF issue has touched a nerve. The November 7 issue of ***Family Circle***, featuring a "Radiation Alert" by Paul Brodeur, was the best-selling issue of the year, according to Executive Editor Susan Ungaro. The six million copies sold had a combined readership of approximately 23 million. Ungaro said that the article has generated a great deal of reader mail and that the magazine may do a follow-up....***Woman's Day***, *Family Circle*'s principal competitor at the supermarket checkout counter, will soon try its hand at EMFs. Watch for an article in March....Even ***People*** magazine is getting on the bandwagon. It ran an interview with Brodeur on November 27.

«« »»

Everybody said it was just a matter of time. Landowners who live along the site of a proposed **BC Hydro** 138 kV power line in the area of Duncan, BC, are demanding that the Canadian utility buy their homes—as it did some of the homes along the 230 kV Dunsmuir-Gold River line on Vancouver Island (see *MWN*, M/J89, J/A89 and S/O89). But BC Hydro has refused, citing the BC Utilities Commission's criticism that it acted "imprudently" in making its unprecedented offer earlier this year. BC Hydro's Peter McMullan told us that the Duncan line is the first the utility has proposed since the commission hearings. One landowner, who already has a 138 kV line running through his farm, told the October 15 *Province*, a local newspaper, that he'll shoot "any Hydro person who sets foot" on his property. For his part, McMullan said that, "It's reasonable to assume that anytime we build or propose a new line, we will have people questioning us. EMFs are an ongoing issue. We accept that." As of November 17, BC Hydro had purchased 21 homes as part of its Dunsmuir-Gold River line buy-out offer.

«« »»

Two years ago in the pages of *Nature* (see *MWN*, J/F88), Dr. **Ken Foster** advocated an end to non-ionizing radiation research. But in a letter to *Science* (October 27), he said that he is willing to support more research if it is "carefully targeted" to reduce the "confusion" engendered by a bioeffects literature "filled with speculation and non-reproducible phenomena." Foster was responding to a *Science* editorial calling for increased support of 60 Hz health research (see *MWN*, J/A89). The editorial was prompted by the OTA report which, among its recommendations, suggested the adoption of a "prudent avoidance" of ELF EMFs (see p.6). Foster, however, believes the bioeffects literature is too weak to support such an avoidance strategy.

## EMFs in the 1989 Popular Press

***Business Week:*** Pam Black, "Rising Tension Over High-Tension Lines," pp.158-160, October 30....***Consumer Reports:*** "Are Electric Blankets Safe?" pp.715-716, November....***Current Contents:*** "Ill Effects From Power Lines and Appliances?" pp.9-10, September 18....***Denver Post:*** Al Knight, "Danger of Electromagnetic Fields Debated," July 16....***Discover:*** David Noland, "Power Play," pp.62-68, December. ...***Family Circle:*** Paul Brodeur, "Radiation Alert," pp.85-90, November 7....***Forbes:*** Peter Huber, "Electrophobia," p.313, September 4....***Ham Radio:*** Craig Clark, "More Cause for Thought," pp.4,89, September....***The Institute (IEEE):*** Karen Fitzgerald, "EM Field Effects Studied," September....***Longevity:*** Ann Marie Cunningham, "Electromagnetic Shocks," pp. 92-93, October....***National Examiner:*** Stephen Langer ("Med Man"), "Kids, Moms-To-Be: Avoid Electric Blankets," p.24, November 28....***New York Times:*** William Stevens, "Scientists Debate Health Hazards of Electromagnetic Fields," p.C1, July 11....***The New Yorker:*** Paul Brodeur, "Annals of Radiation: The Hazards of Electromagnetic Fields," June 12, 19 & 26....***Newsday:*** Robert Park, "Does 60 Hertz Hurt?" Ideas, p.1, October 29....***Newsweek:*** Geoffrey Cowley, "An Electromagnetic Storm," p.77, July 10....***People:*** Dirk Mathison, "Feeling Fatigued and Forgetful? The Power Line Next Door May Be the Source of Your Burnout" (interview with Paul Brodeur), pp.137-141, November 27....***Progressive Architecture:*** Thomas Fisher, "The Next Asbestos?" (editorial), p.7, August. ...***QST:*** Ivan Shulman, "Is Amateur Radio Hazardous to Our Health?" pp.31-33, October....***Science:*** Philip Abelson, "Effects of Electric and Magnetic Fields" (editorial), p.241, July 21....***73 Amateur Radio:*** Wayne Green, "The Killer Blankets," pp.6,68, September....***Time:*** Anastasia Toufexis, "Panic Over Power Lines," p.71, July 17....***USA Today:*** Dan Sperling, "Electric Lines Spark New Cancer Fears," p.1, December 1-3. ...***Wall Street Journal:*** Bill Paul, "IBM To Reduce Radiation from Future VDT Models," p.B1, November 22; Laurence Hooper & John Wilke, "IBM's Plan To Reduce VDT Radiation Fails To Impress Most Computer Makers," p.B3, November 24; Bill Paul, "Radiation Study Finds High Incidence of Cancer Among Phone Cable Splicers," p.B4, November 29; Bill Paul, "Men Exposed to [EMFs] in Study Have Slower Motor Responses," p.B4, December 6.

«« »»

In the November issue of ***Consumer Reports***, Consumers Union (CU) recommended that "children and pregnant women avoid electric blankets and pads," because "perfectly satisfactory alternatives, such as comforters, are available." The advice came in an article, "Are Electric Blankets Safe?" which accompanied an assessment of 21 electric blankets and pads. CU has now parted company with the FDA, which earlier this year told the American public that it "sees no reason" for people to stop heating their beds electrically (see *MWN*, M/J89).

# EMF-Cancer Epidemiological Studies

## I. Residential Studies

| Institution | Principal Investigator(s) | Sponsor(s) | Endpoint(s) | Study Type: No. of Cases/ Controls | Exposures Assessments | Confounder(s)[1] | Approx. Date of Completion |
|---|---|---|---|---|---|---|---|
| Univ. of Leeds UK | David Clayden | CEGB | All CA/c | CC: 374/588 | I | H | 1989[2] |
| USC USA | John Peters | EPRI | L/c | CC: 232/232 | D/I | Ch,IR,PO, Ps,Sm | 1990 |
| Univ. of Leeds UK | Ray Cartwright | CEGB | ALL,AML,CLL, CML,NHL | CC: 3200/3200 | I | H | 1990 |
| Maastricht MS The Netherlands | Jan Meijers | Maastricht MS | All L,BC | Co:3549people, 32-yr.follow-up | I | None | 1991 |
| Karolinska Inst. Sweden | Anders Ahlbom | Karolinska Institute, NBE | L/a,BC/a, all CA/c | CC: (300 L, 425 BC)/725; (200 CA/c)/140 | D/I | E,H,PD, PO,SC | 1991 |
| NTU Taiwan, ROC | Ruey Lin | National Science Council | L/c,BC/c, lymphoma/c | CC: 216/422 | D/I | Al,Ch,IR, MP,PO,Sm | 1991 |
| USC USA | Susan Preston-Martin | State of California | BC/c | CC: 300/300 | D/I | Ch,IR,MP, PO,Ps,SC,W | 1993 |
| Univ.of Toronto Canada | Anthony Miller | OH | L/c | CC: 200/400 | D/I | IR,PO | 1993 |
| Univ.of Helsinki Finland | Markku Koskenvuo | Imatran Voima Oy[3] | CA,CA/c | CC[4], Co[4] | I | J,SC,Sm | 1993 |
| NCI/CCSG USA | Martha Linet Zdenek Hrubec | NCI | L(ALL)/c | CC: 1000/1000 | D/I | Bz,Ch,E,EB,Fm,H, IR,MP,Pb,PD,PO, Ps,PVC,SC,Sm,Sv | 1994 |
| CCABC Canada | Richard Gallagher | EPRI,CEA, HWC | L/c | CC: 395/395 | D/I | Bz,IR, PO,Ps | 1994 |
| IARC France | Peter Boyle | IARC | All L | CC: 1500/1500 | D/I | Bz,EB,Fm,H,IR, PCBs,PO,Ps | 1994 |

1. Partial list; 2. Results due in 1990; 3. A Finnish power company; 4. Numbers to be determined at a later date; 5. Dept. of Social and Preventive Medicine; 6. Data in this listing are unconfirmed.

Adapted and expanded from M. Coleman et al., *Bioelectromagnetics, 11*, 1990 (in press).

*Abbreviations:* **Al:** Alcohol; **ALL:** Acute lymphocytic leukemia; **AML:** Acute myelogenous leukemia; **ANLL:** Acute non-lymphocytic leukemia; **BC:** Brain cancer; **BC/a:** Adult brain cancer; **BC/c:** Childhood brain cancer; **Bz:** Benzene; **CA:** Cancer; **CA/c:** Childhood cancer; **CC:** Case-control; **CCABC:** Cancer Control Agency of British Columbia; **CCSG:** Children's Cancer Study Group; **CEA:** Canadian Electrical Association; **CEGB:** Central Electricity Generating Board; **Ch:** Chemicals; **CLL:** Chronic lymphocytic leukemia; **CML:** Chronic myelogenous leukemia; **Co:** Cohort; **D:** Direct measurements of individuals or workplaces; **E:** Ethnicity; **EB:** Electrically-heated beds; **EDF:** Electricité de France; **EPRI:** Electric Power Research Institute; **FINEP:** Brazilian Research Funding Council; **Fm:** Fumes; **H:** Type of Housing; **HQ:** Hydro-Québec; **HWC:** Health and Welfare Canada; **I:** Indirect estimate of exposure; **IARC:** International Agency for Research on Cancer; **IR:** Ionizing radiation; **J:** Job history; **JHU-SPH:** Johns Hopkins University School of Public Health; **L:** Leukemia; **L/a:** Adult leukemia; **L/c:** Childhood leukemia; **MP:** Medication of parents; **MS:** Medical school; **N/A:** Not available; **NBE:** National Board of Energy, Sweden; **NCI:** National Cancer Institute; **NEA:** National Energy Administration, Sweden; **NHL:** Non-Hodgkin's lymphoma; **NIEHS:** National Institute of Environmental Health Sciences; **NIOH:** National Institute of Occupational Health; **NSPH-OCF:** National School of Public Health, Osvaldo Cruz Foundation; **NTU:** National Taiwan University; **OH:** Ontario Hydro; **Pb:** Lead; **PCBs:** Polychlorinated biphenyls; **PD:** Population density; **PO:** Parents' occupations; **Ps:** Pesticides; **PVC:** Polyvinyl chloride; **RF/MW:** Radiofrequency/microwave radiation; **ROC:** Republic of China; **SC:** Social class; **Sm:** Smoking; **Sv:** Solvents; **UNC:** University of North Carolina; **USC:** University of Southern California; **W:** Drinking water.

# Ongoing Residential and Occupational Epidemiological Studies of EMFs and Cancer

Epidemiologists in 12 countries are now investigating the possible link between electromagnetic field (EMF) exposures and cancer, particularly leukemia and brain tumors.

More than 22 major occupational and residential studies are under way in Australia, Brazil, Canada, Finland, France, The Netherlands, New Zealand, Sweden, Switzerland, Taiwan, the U.K. and the U.S. (where there are seven)—see tables at left and below.

Electric utilities are funding most of the studies. For instance, the Electric Power Research Institute (EPRI) is sponsoring all or parts of six different projects in the U.S. and Canada.

Unlike earlier efforts, the majority of the studies involve direct measurements as opposed to the use of surrogates for magnetic field exposures, such as job title or wire coding indexes. Also, a great deal of emphasis is being placed on controlling for possible confounders, that is, other factors which might be responsible for increasing cancer rates.

Most of the studies will begin to yield results in the early 1990s.

### Savitz and Swedish Studies Completed

Recently, Dr. David Savitz of the University of North Carolina in Chapel Hill found an increase in brain cancer risk among electric utility workers (see next page).

In Sweden, Drs. Bengt Knave and Siv Tornqvist of the National Institute of Occupational Health (NIOH) in Solna have completed an epidemiological study of leukemia and brain cancer among workers in occupations with presumed exposures to extremely low frequency (ELF) magnetic fields.

Knave told *Microwave News* that the study will soon be submitted for publication. The final results were not available at press time.

Texts and Tables © *Microwave News* 1989

## II. Occupational Studies

| Institution | Principal Investigator(s) | Sponsor(s) | Endpoint(s) | Study Type: No. of Cases/ Controls | Exposures Assessments | Confounder(s)[1] | Approx. Date of Completion |
|---|---|---|---|---|---|---|---|
| USC USA | Joseph Bowman | EPRI | ALL,ANLL, CLL,CML | CC[4] | D | Ch,IR, RF/MW | 1990 |
| JHU-SPH USA | Genevieve Matanoski Patrick Breysse | EPRI | All L except CLL | CC: 200/600 | D | J | 1990 |
| JHU-SPH USA | Genevieve Matanoski Patrick Breysse | NIEHS, EPRI | All CA | Co: 391 CA | D | Age,J | 1990 |
| Univ. of Bern[5] Switzerland | Christoph Minder | Swiss National Fund | L, lymphoma | CC: 23/ 177 & 207 | D/I | IR | 1990 |
| Monash MS[6] Australia | Michael Salzberg | N/A | Glioma | CC: 425/850 | I | Ch,SC,Sm | 1991 |
| McGill Univ. Canada | Gilles Thériault | HQ,OH, EDF | L,BC, skin melanoma | CC: 6000/ 17000 | D | Sm,IARC-Ch carcinogens | 1991 |
| UNC USA | David Savitz | EPRI | L,BC | Co: 215 L, 186 BC | D/I | PCBs,Sv | 1991-92 |
| NSPH-OCF Brazil | Sergio Koifman | FINEP | All CA | CC: 347/1129 | I | Sm | 1992 |
| Wellington MS New Zealand | Neil Pearce Peter Bethwaite | Wellington MS | ALL,AML, ANLL | CC: 300/600 | I | E,SC,Sv | 1992 |
| NIOH Sweden | Birgitta Floderus | NEA, NIOH | ALL,AML,CLL, CML,Glioma | CC: 200 BC, 300 L/1000 | D/I | Bz,Fm,PD, SC,Sv | 1992 |

## Savitz Links Brain Cancer to Electrical Occupations

In a new study, Drs. Dana Loomis and David Savitz have found that electrical workers had a significantly elevated mortality from brain tumors. The two epidemiologists at the University of North Carolina in Chapel Hill base the association on an analysis of 410,651 deaths (including 1,095 from malignant brain tumors and 1,694 from leukemia) in 1985 occurring in the 16 states participating in the National Center for Health Statistics industry and occupation coding program.

The class of all electrical workers had a 50% greater than expected rate of brain cancer deaths—an odds ratio (OR) of 1.5 with a 95% confidence interval (CI) of 1.0-2.1. Much of this increase is attributable to the elevated risks among electrical and electronic technicians (OR=3.1) and among electric power repairers and installers (OR=2.4).

There was no elevated mortality due to all leukemias (OR=0.9, CI=0.6-1.3) or due to acute myeloid leukemia (OR=0.9, CI= 0.5-1.8) among all electrical workers. Two subgroups did have higher than expected rates of leukemia, however: electricians (OR=1.8) and electronic technicians (OR=1.9).

"These results are certainly more suggestive of an effect on brain cancer as compared to leukemia," Savitz told *Microwave News*. He added that it is still not clear whether the observed association is related to electromagnetic field (EMF) exposure or to some other aspects of the jobs.

These latest findings support an association between electrical work and brain tumors previously reported by a number of other researchers—Dr. Ruey Lin (see *MWN*, O84 and J/A85), Dr. Sam Milham (see *MWN*, J/A82 and M/A86), Dr. Marjorie Speers (see *MWN*, J/A88) and Dr. Terry Thomas (see *MWN*, S/O87). Speers's study found that the risk of brain cancer among utility workers was 13 times the expected rate for unexposed workers.

Loomis and Savitz presented their findings at the annual meeting of the Society for Epidemiologic Research in Birmingham, AL, in June. Their abstract appears in the *American Journal of Epidemiology, 130*, p.814, 1989. They are preparing a paper for publication that also includes data from 1986. "The results are essentially the same," Savitz said.

The two epidemiologists are also in the midst of a large occupational epidemiological study of brain cancer and leukemia for the Electric Power Research Institute (see p.5).

### New Zealand Results

Dr. Neil Pearce of the Wellington School of Medicine in Wellington, New Zealand, and coworkers have published a new paper, which describes the brain tumor risks associated with various occupations, including electrical workers.

As previously reported, two types of electrical workers had increased rates of brain cancer—electrical engineers (OR=4.74, CI=1.65-13.63) and electricians (OR=1.91, CI=0.84-4.33)—although electrical workers as a whole did not have an increased risk (OR=0.78, CI=0.39-1.59). The team notes that, "The increased risks found for electrical engineers and electricians...are difficult to interpret and may be due to chance."

See John Reif, Neil Pearce and James Fraser, "Occupational Risks for Brain Cancer: A New Zealand Cancer Registry-Based Study," *Journal of Occupational Medicine, 31*, pp.863-867, October 1989. See also their paper, "Case-Control Studies of Cancer in New Zealand Electrical Workers," *International Journal of Epidemiology, 18*, pp.55-59, 1989, and *MWN*, J/A89.

## Colorado PUC Adopts "Prudent Avoidance" Strategy

On November 2, the Colorado Public Utilities Commission (PUC) announced that it will adopt a "prudent avoidance" strategy to minimize electromagnetic field (EMF) exposures from new power lines. The PUC will translate this initiative into statewide rules to find "low cost ways to limit potential dangers," such as re-stringing lines, centering lines in easements and using single pole construction.

The commission's decision followed soon after the Congressional Office of Technology Assessment (OTA) proposed this strategy for dealing with uncertain power line health risks. The Carnegie Mellon University group, which prepared the report for the OTA, suggested routing new lines to avoid populated areas (see *MWN*, J/A89 and S/O89).

The PUC's decision accompanied its tentative approval of a Public Service Company of Colorado proposal to increase the capacity of a 115 kV power line to 230 kV. In so ruling, the PUC reversed a December 1988 decision by the Douglas County Commissioners denying the utility's request for the upgrade primarily because of residents' fears of health risks.

A final order is expected in December.

At a September 11-18 hearing, the commission for the first time considered the issue of potential EMF effects, according to a PUC spokesperson.

Douglas County residents have long opposed the utility's proposal, claiming that upgrading the Daniels Park line—which runs through residential neighborhoods and near a school—would adversely affect residents' health and property values. They have called for Public Service to place the line underground. Burying the line would cost approximately $15 million, as opposed to $5 million for an overhead upgrade, according to the PUC.

The utility refused to consider this alternative, arguing that it has "no right to spend the customers' money to reduce something which the best experts say is not something to be worried about." At the hearing, William Martin, a Public Service vice president, maintained that, "There is no need to avoid the overhead construction of transmission lines if undergrounding them is simply to eliminate the effect of

magnetic fields." He said that, "We have no evidence that there is any need to...minimiz[e] the magnetic field's effect...."

The PUC agreed, at least in part, concluding that "the cost of burying the line was not justified in light of the fact that current medical evidence has not conclusively demonstrated detrimental health effects caused by [EMF] exposure."

On the other hand, Dr. Darwin Labarthe of the Baylor College of Medicine in Houston, TX, who appeared on behalf of the utility, did agree under questioning that a prudent avoidance strategy was worth pursuing.

Residents—though preferring burial of the line—also advocated this strategy. As Lawrence Herbert of Lakewood, CO, told the PUC, "I emphatically encourage the commission to begin mitigating the potential health crisis by removing the involuntary aspect of exposure to power line EMFs and to begin using magnetic fields as a constraint in the design and operation of our electrical energy system in the state of Colorado."

The commission also recommended that Public Service implement design changes in stringing the line to "reduce the [EMF] exposure on nearby residents" and that it conduct a survey within its territory to "determine where the highest exposures to [EMFs] are occurring."

Among those also testifying for the utility were Dr. Richard Bockman of Memorial Sloan-Kettering Cancer Center in New York City and Michael Silva of Enertech Consultants, Inc. in Campbell, CA.

## California PUC Calls EMF Rules "Premature"

In its final report to the state legislature, the California Public Utilities Commission (PUC) has recommended "no action at the present [time] to regulate [EMFs] around electric power facilities" because "such actions are premature given current scientific understanding."

The 1.5-inch-thick report, which was mandated by a 1988 state law (see *MWN*, M/J88 and S/O88), includes descriptions of the previously announced research projects funded by the state (see *MWN*, J/A89), the eight EMF reviews commissioned by the PUC (see *MWN*, N/D88 and M/A89), as well as a statement by the Electric Power Research Institute and public comments.

Copies of *Potential Health Effects of Electric and Magnetic Fields from Electric Power Facilities* are available for $20.00 (free to public agencies), from: Documents Section, California PUC, 505 Van Ness Ave., San Francisco, CA 94102, (415) 557-1812.

## Teachers at Florida Schools To Wear Magnetic Field Meters

A Florida judge has ordered teachers at four schools—including the Sandpiper Shores Elementary School—to wear meters to monitor electromagnetic field (EMF) exposures from nearby high-voltage power lines. In an October 13 order, Judge Timothy Poulton directed the Palm Beach County School Board to pay for the $48,000 measurement program.

The order followed a court ruling in June that children at the Sandpiper school in Boca Raton may not play in the school grounds which border on the high-voltage lines (see *MWN*, J/A89). The suit was filed by three parents who sought to close the school because of potential EMF health risks (see *MWN*, S/O88, J/F89 and M/J89).

In October, a pilot survey revealed an average exposure of approximately 3 mG at the Sandpiper school, according to Dr. Vichate Ungvichian of the Electromagnetic Interference Laboratory at Florida Atlantic University (FAU) in Boca Raton. The reading was not representative of the levels to which the children are regularly exposed, however, because the volunteer—a Sandpiper school vice principal—spent most of the day in his office, Ungvichian said. FAU has been hired by the school board to direct the measurement project.

Lawrence Marraffino, a Boca Raton attorney who represents the parents, told *Microwave News* that the three other schools in the program were selected as controls because they are "identical in design" to the Sandpiper school, but are not located right next to high-voltage lines.

If the levels measured at Sandpiper are significantly higher than those at the three other schools, the parents will again seek to shut the school down, according to Sharon Rausch, one of the parents who brought the original suit.

The program, which began in earnest on November 28, will continue for at least one year. FAU will provide monthly measurement reports to the parents and the school board, which will then submit them to the judge. The reports will later be made available to the public. Upon the program's completion, the school board will donate the six EMDEX-C meters it purchased for $2,000 each to FAU.

The parents originally had requested that students at the school wear the 1.37 lb. monitors.

Over 100 teachers and teaching aides at the four schools have offered to participate in the program, Rausch said. Volunteers will wear monitors one day a week and will record their whereabouts—including proximity to electrical sources—every 15 minutes.

One meter will also be placed in the Sandpiper cafeteria—the room closest to the lines.

"We feel comfortable with the program the way it is now," according to Abbey Hairston, staff attorney for the school board. "The uncertainty has been bad for the school. We want to get rid of that cloud."

"It's very important that we get accurate information and this seems like the best way to get it," Rausch said. "This is the next step in a long process which may continue for years."

### Telephone Linemen Study (continued from p.1)

It is unclear, however, whether these additional cases fall within the defined study population or constitute an abnormal clustering of an extremely rare type of cancer.

Only 900 cases of male breast cancer were expected for the entire United States in 1988, according to American Cancer Society statistics. (In contrast, 135,000 cases of female breast cancer were expected.) Breast cancer is most likely to affect older men, with the peak incidence among those 60 to 69 years old.[1] Prostate cancer often metastasizes to the breast, although this is rarely clinically recognized, according to a recent paper in *Cancer*.[2] The central office technicians also had elevated rates of lymphoma and oral and prostate cancer.

Dr. Richard Stevens of Battelle Pacific Northwest Labs in Richland, WA, has long suggested that EMFs may account for the high rates of breast cancer among women in industrialized countries[3] (see *MWN*, J/F87). In Portland, Stevens told *Microwave News* that Matanoski's findings are "extremely interesting and exciting." For a number of years, Stevens has been trying to raise funds for a case-control study of female breast cancer and its possible link to EMFs—so far unsuccessfully.

Matanoski, Elliott and Breysse also have data on female telephone workers but they have not yet analyzed them.

In a telephone interview after the Portland meeting, Breysse pointed out that the workers in the central offices were exposed to different types of EMFs than were the other telephone linemen. The on-off switching of the equipment generated EMF spikes, which resulted in field exposures that were more complex than simple 60 Hz fields.

Matanoski told *Microwave News* that, "A study of animals exposed to these types of fields is now needed."

Breysse explained that he was unable to measure high frequency transients in the central offices because they are not picked up by the EMDEX meter used in the study. The EMDEX meter was developed by the Electric Power Research Institute (EPRI). It has a 3 dB bandwidth, picking up frequencies from 40 to 300 Hz, according to EPRI's Dr. Stan Sussman.

"It may be that the intensity of the fields isn't the right index of exposure," Breysse said. "The intermittent on-off switching might be more important in terms of biological activity."

In 1987, Drs. Craig Byus and Ross Adey reported that intermittent exposure to 60 Hz EMFs may result in a greater

### Standard Incidence Ratios (SIRs)§

| | Cable Splicers | Central Office Technicians |
|---|---|---|
| | SIRs/No. Cases† | SIRs/No. Cases† |
| All cancers | 1.81*/40 | 1.15/96 |
| All gastrointestinal | 1.76/11 | 1.02/28 |
| Oral | 1.38/2 | 2.45*/9 |
| Stomach | –/0 | ∞/4 |
| Colon | 2.23/5 | 0.54/6 |
| Lung | 2.16/8 | 1.26/19 |
| Leukemia | 7.00*/3 | 1.07/2 |
| Lymphoid | ∞/2 | ∞/1 |
| Myeloid | 2.33/1 | 0.53/1 |
| Brain | 1.79/2 | 0.90/4 |
| Lymphomas | 3.59*/5 | 1.94/8 |
| Multiple Myeloma | –/0 | ∞/1 |
| Breast | –/0 | ∞/2 |
| Prostate | 4.38/3 | 3.48*/9 |
| Bladder | 0.60/1 | 0.78/5 |

§ SIRs are the ratios of observed to expected numbers of cancer cases, using nonline workers as the control group.
† Among 4,547 cable splicers and 9,561 central office technicians
* Statistically significant at the 95% level
∞ No cases expected

### Matanoski, EPRI & the Media

A few days before the DOE-EPRI meeting in Portland, OR, EPRI President Richard Balzhiser alerted the chief executive officers (CEOs) of all of the institute's member utilities to the impending announcement of Dr. Genevieve Matanoski's study results.

"These results...may attract national attention because they suggest an increased risk of cancer among workers exposed to EMFs," Balzhiser wrote in his November 10 letter.

EPRI also sent out a three-page "Questions and Answers" background paper on Matanoski's "unexpected" results to a number of newspapers. The *Wall Street Journal* ran a story on November 29, prompting the Associated Press to write its own version and put it on the wire. The following day, the Matanoski study made headlines in newspapers and on radio and television coast-to-coast. On December 1, it was featured on the front page of *USA Today*.

EPRI's unsolicited release of the Johns Hopkins findings surprised some journalists. As one veteran reporter told *Microwave News*, "Something has happened to make the big boys scared."

In his letter, Balzhiser advised the CEOs that, "These results are preliminary and clearly warrant further study." He went on to say that EPRI is "committed to pursuing this work objectively by providing support to outstanding researchers in the field, such as [Dr.] Matanoski. In addition, [EPRI] will be initiating research aimed at identifying technological options for addressing the issue, should this prove necessary."

risk of cancer promotion than does continuous exposure[4] (see *MWN*, N/D87).

There was some variation in the 60 Hz magnetic field exposures. Among the central office technicians, the average levels ranged from 0.6 to 10.9 mG, with a mean of 2.7 mG. The cable splicers were exposed to average fields of 4.3 mG, ranging from 0.6 to 23 mG.

Breysse said that he wants to investigate further the EMFs in the central offices—but this may be difficult. Since the measurements were taken, the telephone company has replaced most of the older electromechanical switches with new solid-state electronic ones. The older units were operated manually by technicians, entailing EMF exposures. Today, it is virtually impossible to find large facilities still using the old switches. Breysse said that he might have to go outside the U.S. to measure EMFs from older equipment.

The JHU team will most likely submit the results of both the New York and the national studies for publication in 1990.

The New York study is supported by the National Institute of Environmental Health Sciences and by EPRI. EPRI is the sole sponsor of the original leukemia mortality study.

1. H.Y. Yap et al.,"Male Breast Cancer: A Natural History Study," *Cancer, 44*, pp.748-754, August 1979.

2. Robert M. Moldwin and Eduardo Orihuela, "Breast Masses Associated With Adenocarcinoma of the Prostate," *Cancer, 63*, pp. 2229-2233, June 1, 1989.

3. Richard Stevens, "Electric Power Use and Breast Cancer: A Hypothesis," *American Journal of Epidemiology, 125*, pp.556-561, 1987.

4. Craig V. Byus, Susan E. Pieper and W. Ross Adey, "The Effects of Low-Energy 60 Hz Environmental Electromagnetic Fields Upon the Growth-Related Enzyme Ornithine Decarboxylase," *Carcinogenesis, 8*, pp.1385-1389, October 1987.

# HIGHLIGHTS

## IBM Markets Low VLF Radiation VDTs Worldwide

IBM has introduced a new line of computer terminals that are shielded to reduce magnetic fields. The move came "in response to an emerging customer requirement," Paul Snayd, manager of Video Display Terminals (VDTs) and Special Needs Programs at IBM's Personal Systems Division, told *Microwave News*. Previously, IBM sold low magnetic field terminals only in Denmark and Sweden.

The terminals meet the Swedish standards for very low frequency (VLF) magnetic fields, Rita Black, an IBM spokeswoman, said in an interview (see *MWN*, S/O88 and M/J89 for more on Swedish standards). When asked to estimate the cost of adding magnetic shielding, Snayd replied that it was "impossible to determine"—he said he could not separate it from the overall cost of the unit. The terminals are not shielded at extremely low frequencies (ELF).

A spokeswoman for Digital Equipment Corp. (DEC), based in Maynard, MA, said that DEC has been marketing low magnetic field VDTs for some time. The shielded DEC terminals cost $200 more than comparable unshielded units.

The new IBM InfoWindow flat displays, which are also designed to reduce reflections and to improve resolution, were announced in September. At present, the monochrome and color terminals are available in the U.S. and Canada for use only with mid-range and mainframe computers. Terminals for personal computers will be introduced in the first quarter of 1990, Black said.

On August 17, 1987, IBM applied for a U.S. patent for a "relatively inexpensive" way to modify a cathode ray tube (CRT) to reduce magnetic fields at the operator's position. In its application, IBM stated that tests had "demonstrated dramatic reductions in the unwanted radiation in front of CRTs."

A copy of IBM's application (No.084949) was obtained by *Microwave News* after IBM refused to release it due to its

## Leukemia Linked to Chronic Microwave Exposure

Chronic exposure to microwave radiation may lead to the development of acute myelogenous leukemia (AML), according to a group of French physicians.

In a case report appearing in the October issue of the *British Journal of Haematology*, the doctors note that, to the best of their knowledge, this is the first reported case of AML attributable to microwaves.

A 46-year-old man who had worked as a microwave technician for 22 years was diagnosed with AML in November 1988. His job was to maintain powerful (up to 3 kW) microwave generators used in professional microwave ovens—the work involved turning each unshielded generator on for one minute, five or six times a day, six days a week. He was not exposed to any known carcinogenic chemicals on the job.

The technician had abnormally developed myeloid blood cells and genetic abnormalities, including a missing chromosome (No.7) and a translocation. Treatment, which included chemotherapy and a bone marrow transplant, failed and he died four months after diagnosis.

See Eric Archimbaud et al., "Acute Myelogenous Leukaemia Following Exposure to Microwaves," *British Journal of Haematology, 73*, pp.272-273, October 1989. Archimbaud and coworkers are based at the Edouard Herriot Hospital in Lyon.

"proprietary" nature. Cynthia Stevens, an IBM spokeswoman in Armonk, NY, said that the patent has not yet been granted by the Patent and Trademark Office at the U.S. Department of Commerce.

According to the patent application, IBM can reduce VLF magnetic fields to a level five to ten times less than that from an unshielded CRT. At a distance of 55 cm from the neck ("yoke") of an unshielded CRT, the magnetic field is in the range of 1-2 μT (10-20 mG). In the patent claim, IBM stated that its shielding system reduces that field to less than 0.2 μT.

The shielding consists of a "magnetic shunt"—a ring made of magnetically permeable material—which is attached to the yoke of the CRT. In its application, IBM noted that: "The invention may be embodied in forms which are made of relatively inexpensive linear ferrite materials configured in shapes that are inexpensive to provide."

## RF Radiation: Focus on Broadcaster Compliance

The magnetic fields at the base of quarter-wavelength AM radio towers are more likely to exceed safety standards than are electric fields, according to a survey by Richard Tell for the Federal Communications Commission (FCC). Tell, of Richard Tell Associates in Las Vegas, NV, also found that the FCC's model for predicting AM radiation levels tends to overestimate the necessary safety zones around broadcast towers.

In a second report, prepared for the National Association of Broadcasters (NAB), Tell found that, in many cases, radiofrequency (RF) "hot spots" from radio and television stations should not be interpreted as violations of the FCC's RF rules, which are based on the 1982 American National Standards Institute (ANSI) guidelines.

Last year, prompted by a petition from Hammett & Edison, a consulting engineering firm in San Francisco, CA, the FCC issued proposed guidelines for addressing hot spots (see *MWN*, S/O87 and S/O88). A final decision on these proposals is now before the FCC.

On the basis of measurements at four Las Vegas AM stations, three directional and one non-directional, Tell concluded that, "At locations very near the base of AM towers, there can be spatial variation in the RF field strengths." He advised that compliance assessment include measurements all around the perimeter of a tower to "insure finding the maximum field level."

Tell found that the FCC's OST Bulletin No.65, which presents a way of estimating RF fields from broadcast sources (see *MWN*, S/O85), is "very conservative"—that is, the models "over-predict" the actual field levels. This conclusion agrees with that of Dr. Robert Cleveland of the FCC and Edwin Mantiply of the Environmental Protection Agency. At the Bioelectromagnetics Society meeting last June, they reported that, based on their own AM surveys, in most cases "computer techniques over-predicted actual electromagnetic field levels."

Tell also told the FCC that the contact currents from some guy wires at AM stations can exceed 100 mA and that touching these wires can result in RF burns. He added that there are simple ways to control these risks.

Among Tell's other findings in his report to the NAB on very high frequency (VHF) broadcast stations: surface field strengths are not good indicators of the specific absorption rates (SARs) which can result from contact with the source; contact currents are meaningful surrogates of peak SARs; and simple meters can be built to measure contact currents.

"We have shown that there is a practical way to estimate peak SARs on-site for broadcast sources," Tell told *Microwave News*.

*Electric and Magnetic Fields and Contact Currents Near AM Standard Broadcast Radio Stations* (FCC/OET RTA 89-01), August 23, 1989, is available for $15.95 plus $3.00 shipping and handling from: National Technical Information Service, Springfield, VA, 22161, (800) 336-4700; order No. PB89234850. *An Investigation of RF Induced Hot Spots and Their Significance Relative to Determining Compliance with the ANSI [RF] Protection Guide*, July 3, 1989, is available free from: NAB Science and Technology Dept., 1771 N St., NW, Washington, DC 20036, (202) 429-5350. A report by Cleveland and Mantiply is due by mid-1990.

### BENER Digest To End

The Office of Naval Research (ONR) has refused to renew its sponsorship of the quarterly digest of the technical literature on the *Biological Effects of Non-Ionizing Electromagnetic Radiation (BENER)*. The digest, which first appeared in 1974, will cease publication after the release of issue *13* (1), now at the printer.

When asked why the ONR would no longer support the digest, an ONR spokesman replied that it was because, "We no longer have a program in the [non-ionizing radiation] area." Other federal agencies had funded the digest before the Navy.

The digest is compiled by Dr. Bruce Kleinstein of Information Ventures, Inc. in Philadelphia, PA. Kleinstein told *Microwave News* that he is seeking new funding from several federal agencies, but none has yet come up with the necessary money.

Dr. Imre Gyuk, program manager for electromagnetic research at the Department of Energy (DOE) conceded that there was "little probability" that DOE would pick up the *BENER* digest. "It's worthwhile, but difficult to fit into our setup," he said.

The digest is distributed to 650 readers around the world at no charge.

## FAA Ranks Protecting Avionics From EMI as High Priority

The Federal Aviation Administration (FAA) has initiated a high priority program to protect electronic flight systems from high-power radiofrequency and microwave (RF/MW) radiation. The agency is now in the process of developing electromagnetic interference (EMI) standards and expects to issue proposed rules by the end of 1990, with final standards due in mid-1991.

The agency is considering barring susceptible aircraft from regions with high-power RF/MW sources in the 10 kHz to 14 GHz frequency range. For the present, the FAA has established interim shielding specifications: 200 V/m for new critical flight systems and 100 V/m for modified systems.

The agency's interest was sparked by reports of accidents attributed to EMI involving military aircraft equipped with advanced electronics, an FAA aerospace engineer told *Microwave News*. Over the past few years, such high-tech aircraft as the U.S. Army's Black Hawk and Apache helicopters and the U.K.'s Tornado have been plagued with EMI-related incidents (see *MWN*, N/D87, S/O88, N/D88 and M/A89). The engineer noted, however, that there have been no such incidents involving civilian aircraft.

While the FAA proceeds with developing new rules, the aviation industry is downplaying the seriousness of the problem, maintaining that it is still "premature" to regulate.

Economics are no doubt at the heart of the disagreement. As one seasoned EMI expert explained, "Anytime you increase the level of protection, you jack up the price of the equipment."

In an FAA position paper issued this spring, the agency cited the increased use of advanced digital technology that is susceptible to interference and the "dramatically" higher power levels from radio, TV and radar emitters as reasons for concern. The use of composite materials with "lower shielding effectiveness" was also noted. The combination of these three developments results in an "increased susceptibility level of electrical and electronic systems to electromagnetic fields," the FAA concluded.

Describing the existing rules as "inadequate," the FAA called for federal aviation regulations to protect electrical and electronic systems from high energy fields and also called for radiated energy emitters to be monitored and controlled.

At a July 12 briefing, the FAA predicted maximum RF/MW field strengths that could be encountered by aircraft—the so-called "threat envelope." In the 1-10 MHz frequency band, field strengths may be as high as 1 kV/m; in the 1-10 GHz range, they may reach 14 kV/m. Shipboard radars are among the common sources of such powerful fields, according to the FAA aerospace engineer.

The FAA has concluded that the "predicted environment is real" and that "critical electrical and electronic systems must be protected."

The Society for Automotive Engineers (SAE) and the Radio Technical Commission for Aeronautics (RTCA) have set up special subcommittees to define test methods and to update the RTCA environmental standards for critical systems, respectively. In a draft report issued at the end of last year, an RTCA committee recommended that airline passengers not use computers and other electronic devices during takeoffs and landings to guard against EMI (see *MWN*, N/D88).

In a July 24 letter to the FAA, Stanley J. Green, vice president of the General Aviation Manufacturers Association (GAMA), claimed that instances in which civilian aircraft have been affected by high energy RF/MW fields have been rare and that "the problems seem to be extreme nuisances rather than specific safety issues." Green's letter followed the July 12 briefing at which GAMA and other industry groups discussed high energy RF/MW fields with the FAA.

In contrast to the FAA, Green contended that "properly designed digital systems and composite-airframes are *less* susceptible to [these fields]...than their analog avionics and metal airframe counterparts" and that "all observed or suspected [interference] events have been with 'older' aircraft."

With regard to the EMI-related military accidents, Green added that "the critical flight systems on most of these aircraft were analog systems."

Industry would also like to see more controls on RF/MW emitters. "How can you tell the manufacturers that they have to meet these levels without putting some controls on the sources?" Green told *Microwave News*.

See also *Avionics System Design for High Energy Fields* (DOT/FAA/CT-87/19), available from: National Technical Information Service, Springfield, VA 22161.

## NIER in Nordic Countries

Agencies in Denmark, Finland, Norway and Sweden have relatively large research programs on non-ionizing electromagnetic radiation (NIER). A review of their efforts is now available in a report issued by the Swedish National Institute of Radiation Protection (NIRP).

The report is the proceedings of a conference held at NIRP on May 29-30, 1989. The first day was devoted to optical radiation, and the second to extremely low frequency (ELF), very low frequency (VLF), radiofrequency (RF) and video display terminal (VDT) radiation.

Among the topics covered were: Swedish surveys of VDT emissions, Swedish research on ELF and VLF radiation effects on chromosomal aberrations and on VLF effects on pregnant mice, NIER legislation and standards in Sweden and Finland, Finnish RF meters and a listing of ongoing research.

A copy of *2nd Nordic Meeting on Non-Ionizing Radiation* (Report No.89-15) is available for 50 Kr. (approximately $8.00) from: Peter Williams, NIRP, Box 60204, S-104 01 Stockholm, Sweden, (08) 729-7100.

# CONFERENCES

## 1990 Conference Calendar

January 3-5: **3rd International Conference on Fundamentals of Bone Growth: Methodology and Applications,** University of California, Los Angeles (UCLA), CA. Contact: Dr. Andrew Dixon, Schools of Dentistry and Medicine, 63-090 CHS, UCLA, Los Angeles, CA 90024, (213) 825-1761.

February 4-9: **IEEE Power Engineering Society Winter Meeting,** Westin Peachtree Plaza, Atlanta, GA. Contact: Nancy Heitmann, IEEE Special Services, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855, (201) 562-3882.

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, 3685 Motor Ave., Suite 240, Los Angeles, CA 90034, (213) 287-1463.

February 18-22: **34th Annual Meeting of the Biophysical Society,** Convention Center, Baltimore, MD. Contact: Biophysical Society, 9650 Rockville Pike, Bethesda, MD 20814, (301) 530-7114.

March 25-28: **1st International Congress on Therapeutic Electromedicine and Lasers,** Hyatt Regency, Jerusalem, Israel. Contact: Dr. Zion Singer, Open University of Israel, PO Box 39328, Tel Aviv, 61392 Israel.

March 26-27: **16th Annual Northeast Bioengineering Conference,** Pennsylvania State University, University Park, PA. Contact: Roger P. Gaumond, Bioengineering Program, 230 Hallowell Bldg., Pennsylvania State University, University Park, PA 16802, (814) 865-1407.

March 30-April 3: **44th Annual Broadcast Engineering Conference** and **68th Annual Convention of the National Association of Broadcasters (NAB),** World Congress Center, Atlanta, GA. Contact: Engineering Conference Committee, NAB, 1771 N St., NW, Washington, DC 20036, (202) 429-5346.

April 1-5: **74th Annual Meeting of the Federation of American Societies for Experimental Biology (FASEB)**—includes the *International Society for Bioelectricity,* Washington, DC. Contact: FASEB Office of Scientific Meetings, 9650 Rockville Pike, Bethesda, MD 20814.

April 4-5: **26th Annual Meeting of the National Council on Radiation Protection and Measurements (NCRP),** Mayflower Hotel, Washington, DC. Contact: NCRP, 7910 Woodmont Ave., Suite 800, Bethesda, MD 20814, (301) 657-2652.

April 7-12: **38th Annual Meeting of the Radiation Research Society** and **10th Annual Meeting of the North American Hyperthermia Group,** Sheraton Hotel & Tower, New Orleans, LA. Contact: Radiation Research Society, 1101 Market St., 14th Floor, Philadelphia, PA 19107, (215) 574-3153.

April 16-21: **2nd International Symposium on Microwave Processing of Materials,** San Francisco, CA. Contact: Materials Research Society, 9800 McKnight Rd., Suite 327, Pittsburgh, PA 15237.

April 17-20: **International Magnetics Conference (INTERMAG'90),** Metropole Hotel, Brighton, U.K. Contact: Courtesy Associates, 655 15th St., NW, Suite 300, Washington, DC 20005, (202) 639-5088.

April 24-27: **Electrical Potpourri,** Transmission Line Mechanical Research Center, Haslet, TX. Contact: Richard Kennon, EPRI, PO Box 10412, Palo Alto, CA 94303.

April 25-27: **6th Annual Meeting of the Electromagnetic Energy Policy Alliance (EEPA),** Radisson Mark Plaza Hotel, Alexandria, VA. Contact: Richard Ekfelt, EEPA, 1255 23rd St., NW, Washington, DC 20037, (202) 452-1070.

May 1-3: **6th International Ionospheric Effects Symposium,** Washington, DC. Contact: Ionospheric Effects Symposium Coordinator, Code 4180, Naval Research Laboratory, Washington, DC 20375.

May 5-9: **25th Annual Meeting of the Association for the Advancement of Medical Instrumentation (AAMI),** Anaheim Marriott Hotel, Anaheim, CA. Contact: AAMI, 3330 Washington Blvd., Suite 400, Arlington, VA 22201, (800) 332-2264, or (703) 525-4890 (in VA).

May 6-10: **Annual National Conference on Radiation Control,** Marriott Hotel, Salt Lake City, UT. Contact: Conference of Radiation Control Program Directors, 71 Fountain PL, Frankfort, KY 40601, (502) 227-4543.

May 6-11: **12th World Congress on Occupational Safety and Health,** Congress Centrum, Hamburg, F.R.G. Contact: Hamburg Messe und Congress GmbH, Postfach 30 24 80, D-2000 Hamburg 36, F.R.G., (040) 35 69 22 42.

May 7-10: **IEEE 1990 International Radar Conference,** Marriott Crystal Gateway Hotel, Arlington, VA. Contact: Robert Hill, ITT Defense, 1000 Wilson Blvd., 30th Fl., Arlington, VA 22209.

May 7-11: **IEEE AP-S International Symposium & URSI Radio Science Meeting,** Dallas Convention Center, Dallas, TX. Contact: Dr. Oren Kesler, PO Box 860130, Plano, TX 75086, (214) 952-3772.

May 8-10: **IEEE MTT-S International Microwave Symposium,** Dallas, TX. Contact: Tatsuo Itoh, c/o LRW Associates, 1218 Balfour Dr., Arnold, MD 21012.

May 13-14: **Annual Meeting of the Society for Light Treatment and Biological Rhythms (SLTBR)**—a satellite of the annual meetings of the *American Psychiatric Association,* May 12-17, and the *Society of Biological Psychiatry,* May 9-13, New York, NY. Contact: SLTBR Annual Meeting, 722 West 168th St., Box 50, New York, NY 10032.

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.

May 23-25: **44th Annual Frequency Control Symposium,** Stouffer Harbor Place Hotel, Baltimore, MD. Contact: Dr. R.L. Filler, U.S. Army Electronics Technology and Devices Lab, ATTN: SLCET-EQ, Fort Monmouth, NJ 07703, (201) 544-2467.

June 5-7: **4th International Conference on Advanced Infrared Detectors and Systems,** London, U.K. Contact: Institution of Electrical Engineers (IEE), Savoy PL, London WC2R 0BL, U.K., (01) 240-1871, ext. 222.

June 10-14: **12th Annual Meeting of the Bioelectromagnetics Society (BEMS),** Marriott Riverwalk Hotel, San Antonio, TX. Contact: BEMS, 120 W. Church St., Frederick, MD 21701, (301) 663-4252.

June 11-13: **11th Annual Meeting of the Canadian Radiation Protection Association,** Saint John, New Brunswick, Canada. Contact: Dr. J.J. Paciga, Health Physics Dept., Point Lepreau Generating Station, PO Box 10, Lepreau, New Brunswick E0G 2H0, Canada, (506) 659-2220.

June 11-14: **Conference on Precision Electromagnetic Measurements,** Westin Hotel, Ottawa, Ontario, Canada. Contact: National Research Council of Canada, Bldg. M19, Montreal Rd., Ottawa, Ontario K1A 0R6, Canada, (613) 993-9009.

### In Our Next Issue...

- Book Reviews
- Power Line EMF Meters

June 17-22: **Health Physics Society (HPS) Summer School: Assessing Non-Ionizing Radiation Hazards,** Fullerton, CA. Contact: John Elliott, California State University, Radiation Safety Office, Fullerton, CA 92634, (714) 773-2687.

June 24-28: **35th Annual Meeting of the Health Physics Society (HPS),** Anaheim, CA. Contact: HPS, 8000 Westpark Dr., Suite 400, McLean, VA 22102, (703) 790-1745.

June 26-29: **10th International Wroclaw Symposium on Electromagnetic Compatibility,** Wroclaw, Poland. Contact: Dr. W. Morón, Box 2141, 51-645 Wroclaw 12, Poland.

July 15-19: **1990 IEEE Power Engineering Society Summer Meeting,** Marriott Hotel, Minneapolis, MN. Contact: Bruce F. Wollenberg, Control Data Corp., Energy Management Systems, 2300 Berkshire Lane N., Plymouth, MA 55441, (612) 553-4357.

July 23-27: **5th International Conference on Radio Receivers and Associated Systems,** Churchill College, Cambridge, U.K. Contact: IEE, see June 5-7 above.

July 23-27: **1990 Bioelectrochemistry Gordon Conference,** Proctor Academy, Andover, NH. Contact: Dr. Mays Swicord, FDA, [HFZ-114], 5600 Fishers Lane, Rockville, MD 20857, (301) 443-7153.

July 23-27: **Non-Ionizing Radiations: Health Physics & Radiation Protection,** Massachusetts Institute of Technology (MIT), Cambridge, MA. Contact: Director of Summer Sessions, Room E19-356, MIT, Cambridge, MA 02139, (617) 253-2101.

August 13-15: **Annual Meeting of the International Society of Environmental Epidemiology,** Berkeley, CA. Contact: Dr. Raymond Neutra, Epidemiology Studies Section, Dept. of Health Services, 2151 Berkeley Way, Berkeley, CA 94704, (415) 540-2924.

August 21-23: **IEEE International Symposium on Electromagnetic Compatibility,** Washington Hilton Hotel, Washington, DC. Contact: Dr. William G. Duff, Atlantic Research Corp., 5390 Cherokee Ave., Alexandria, VA 22312, (703) 642-4049.

August 27-29: **25th Annual Microwave Power Symposium,** Sheraton Tech Center, Denver, CO. Contact: Robert LaGasse, International Microwave Power Institute, 13542 Union Village Circle, Clifton, VA 22024, (703) 830-5588.

August 28-31: **7th International Conference on Electromagnetic Compatibility,** University of York, U.K. Contact: IEE, see June 5-7 above.

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.

September 10-13: **12th Annual Electrical Overstress/Electrostatic Discharge (EOS/ESD) Symposium,** Lake Buena Vista, FL. Contact: Betty Post, EOS/ESD Association, 201 Mill St., Rome, NY 13440, (315) 339-6937.

September 10-13: **20th European Microwave Conference,** Intercontinental Hotel, Budapest, Hungary. Contact: Microwave Exhibitions & Publishers, Ltd., 90 Calverley Rd., Tunbridge Wells, Kent TN1 2UN, U.K., (0892) 544027.

September 18-21: **3rd Asia-Pacific Microwave Conference,** Sunshine City Prince Hotel and Convention Center, Tokyo, Japan. Contact: Prof. Yoshiyuki Naito, c/o Business Center for Academic Societies Japan, 3-23-1 Hongo, Bunkyo-ku, Tokyo 113, Japan, (3) 817-5831.

September 22-28: **23rd International Congress on Occupational Health of the International Commission on Occupational Health,** including a mini-symposium on ***Exposure to Low-Frequency Electromagnetic Fields —An Occupational Health Hazard?*** Montréal, Québec, Canada. Contact: Congress Secrétariat, 58 de Brésoles, Suite 2, Montréal, Québec H2Y 1V5, Canada, (514) 499-9835.

September 26-28: **Energy and the Environment Conference & Exhibition,** Denver, CO. Contact: Electric Utility Consultants, Inc., PO Box 20351, Englewood, CO 80156.

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.

October 14-17: **10th Anniversary Meeting of the Bioelectrical Repair and Growth Society (BRAGS),** Penn Tower Hotel, Philadelphia, PA. Contact: Executive Secretary, BRAGS, PO Box 64, Dresher, PA 19025, (215) 659-5180.

October 17-19: **EPRI EMF Utility Seminar,** Four Seasons Hotel, Austin, TX. Contact: Robert S. Banks Associates, Inc., PO Box 10574, University Station, Minneapolis, MN 55414, (612) 623-4646.

October 26-28: **International Congress on Molecular Changes by Microwaves,** Vienna, Austria. Contact: Prof. Gert Lubec, 99 Muswell Ave., Muswell Hill, London N10 2EJ, U.K., (01) 883-9095.

October 28-November 1: **IEEE Power Engineering Society (PES) International Power Meeting—India,** New Delhi, India. Contact: T.W. Hissey, Leeds & Northrup Co., Sumneytown Pike, North Wales, PA 19454, (215) 699-2000.

November 1-4: **12th Annual International Meeting of the IEEE Engineering in Medicine & Biology Society,** Wyndham Franklin Plaza Hotel, Philadelphia, PA. Contact: Dr. Nihat Bilgutay, Electrical and Computer Engineering Dept., Drexel University, Philadelphia, PA 19104, (215) 895-2257.

November 13-15: **JINA'90 International Symposium on Antennas,** Nice, France. Contact: Secrétariat JINA'90, M. Guiraud, CNET-PAB Centre de La Turbie, 06320 La Turbie, France, (33) 93 41 15 30.

# *UPDATES*

## *COMPATIBILITY & INTERFERENCE*

**Big Mac Attacks...**EMI with electronic restaurant equipment has prompted McDonald's Corp., the world's largest fast-food chain, to develop its own EMC standards. In the September/October issue of *EMC Technology*, Fernando Esparza, a McDonald's EMC expert, describes how a number of McDonald's restaurants have been plagued by mysterious electrical glitches. For example, cash register drawers at one drive-thru restaurant kept opening by themselves until it was discovered that the ghost-like withdrawals coincided with visits by police cars equipped with high-power communications gear. Every time a police car responded to a call while at the drive-thru window, the cash drawers shot open. Installation of an RF filter resolved the problem. Another restaurant reported frequent "ghost orders" on its system—spurious requests for burgers, fries and drinks. In this case, conducted—rather than radiated—signals were responsible. A power line filter cleared up the phantom orders. Esparza notes that McDonald's felt compelled to set its own standards due to the

lack of published EMC limits. Copies of McDonald's *Electrical Disturbance Standards* are available for $12.25 from: ICT Publications Group, PO Box D, Gainesville, VA 22065.

**Power Lines No Hazard to EEDs...**An analysis by Thomas Baginski of Auburn University in Auburn, AL, indicates that overhead transmission lines and substations do not present a risk to electro-explosive devices (EEDs). Even under worst-case conditions, the induced currents from electric or magnetic fields will not detonate an unshielded EED. Baginski's paper appears in the *IEEE Transactions on Electromagnetic Compatibility, 31*, pp.393-395, November 1989.

## INTERNATIONAL

**European Society Off and Running...**On December 15, the European Bioelectromagnetics Association (EBEA) will be officially launched in Madrid, Spain (see *MWN*, M/J89). The founding members are: Drs. Alessandro Chiabrera (Italy), Richard Dixey (U.K.), Maurice Hinsenkamp (Belgium), Jocelyne Leal (Spain) and Bernard Veyret (France). Still under discussion are the specific details of a planned cooperative agreement between EBEA and the U.S.-based Bioelectromagnetics Society (BEMS). For more information, contact: Dr. Jocelyne Leal, Department of Research, Hospital Ramón y Cajal, Carreterra de Colmenar, Km 9, Madrid 28034, Spain, (1) 336-8699.

## MEETINGS

**Membranes and Cancer...**The New York Academy of Sciences has published the proceedings of a conference on *Biological Membranes in Cancer Cells*, held in Perugia, Italy, in June 1988. The conference was held in honor of Dr. Britton Chance's 75th birthday. The proceedings are collected in Volume 551 of the *Annals of the New York Academy of Sciences*, December 30, 1988.

## MILITARY SYSTEMS

**More on PAVE PAWS and EEDs...**The PAVE PAWS radar at Robins AFB, GA, poses a "possible risk to aircraft with internal [electro-explosive devices] EEDs," the USAF admitted in a September letter to Senator Sam Nunn (D-GA). Last year, the USAF acknowledged that planes with *external* EEDs may be in danger when flying through the radar's main beam (see *MWN*, J/A88 and N/D88). Soon after, Nunn, chairman of the Senate Armed Forces Committee, asked the USAF to investigate the potential hazards and the long-term adequacy of the current system (see *MWN*, J/F89). In his September 1989 letter, released in late November, Major General Burton Moore assured Nunn that the USAF is implementing "procedures to ensure aircraft with internal EEDs are also protected," but also that the procedures "will not reduce the scope of Robins AFB air operations or restrict planning for future operations." Nunn was far from satisfied, however. On November 20, he wrote back that the USAF has not "fully addressed all of the issues I raised" and that the letter "raises a number of additional questions"—i.e., "Is the [USAF] still attempting to find a solution that...restores both unrestricted flight operations and uninterrupted radar operations?" Meanwhile, USAF Lt. Col. Joseph Purka told Stuart Leavenworth of the *Macon Telegraph and News* (November 23) that a PAVE PAWS power upgrade "hasn't been ruled out."

## PEOPLE

**Dave Janes**, who was in charge of EPA's non-ionizing radiation program before his retirement in October, is now a consultant working with Dr. **David Rosenbaum** at Risk Analysis Corp. in McLean, VA. Rosenbaum is a former director of EPA's Office of Radiation Programs (ORP). **Marty Halper** has taken over Janes's post as the head of the ORP's Analysis and Support Division. Halper comes from EPA's Office of Toxic Substances....Dr. **Jan Walleczek** has joined Dr. **Robert Liburdy**'s Bioelectromagnetics Research Facility at the Lawrence Berkeley Lab in Berkeley, CA, as a visiting scientist. Walleczek's work is being sponsored by the West German DFG, analagous to the U.S.'s NSF.

## RESOURCES

**Of Particular Interest...**Drs. M.A. Uman and E.P. Krider provide a fascinating look at "Natural and Artificially Initiated Lightning" in the October 27 *Science*....In the December *Scientific American*, Drs. Jeremy Bloxham and David Gubbins describe "The Evolution of the Earth's Magnetic Field."

## ETC...

**Baby Party Line...**If you hear a baby crying, it might not be your own—if you use a walkie-talkie baby monitor. Parents in a Miami, FL, neighborhood who own Fisher-Price crib monitors have been picking up the cries of their neighbors' infants—and their neighbors' conversations—according to a Knight-Ridder news service report in the November 2 *Washington Post*. The problem is overlapping signals, says Fisher-Price; other brands of baby monitors are equally vulnerable in neighborhoods with many young families. The units consist of a transmitter placed in the crib and a receiver placed near the parents. For its part, Fisher-Price suggests that parents turn off the monitors when they're not using them because "somebody could be listening" in.

**The KGB Signal...**Boris Yeltsin, the populist politician who swings in and out of favor in the Soviet Union, has told a reporter that the KGB has an ELF device that can stop a human heart from beating. In an interview with Radio Liberty, a U.S.-backed shortwave radio station in West Germany, Yeltsin said that KGB agents told him that they have a device which emits a powerful 7-11 Hz signal which can stop the heart. According to Yeltsin, the KGB agents said that, "If emergency medical aid isn't close at hand, it's all over." The radio interview was reported by the *Baltimore Sun* on October 20.

# Swedish Academy of Sciences on Low-Level EMF Effects

*On May 25-27, the Royal Swedish Academy of Sciences held a workshop on* Interaction Mechanisms of Low-Level Electromagnetic Fields [EMFs] in Living Systems—Resonant Phenomena *(see* MWN, *M/A89). Reprinted below are the conclusions from that meeting. Dr. Bengt Nordén is with the Chalmers University of Technology in Göteborg and Dr. Claes Ramel is with Stockholm University.*

*Soon after the meeting, a working group, whose members included Nordén and Ramel, issued a statement. This was later withdrawn and replaced by the version presented here.*

During the past decade there has been an increasing concern that weak, low-frequency [EMFs] might have significant effects on biological systems. With the intent of promoting understanding of possible basic interaction mechanisms, the Environmental Committee of the Royal Swedish Academy of Sciences organized an international workshop on the subject *Interaction Mechanisms of Low-Level Electromagnetic Fields in Living Systems—Resonant Phenomena*. The workshop concentrated on some recently reported phenomena indicating that weak, extremely low frequency [EMFs] might interact in an apparently resonant manner with certain cellular systems. The presentations by the invited speakers included studies of biosynthesis, ion-transport phenomena, and epidemiological studies, and the effects of fields of varying frequency and strength on these systems. In addition, theoretical considerations of resonance interactions were presented, more specifically, calculations based on the so-called cyclotron resonance model.

The epidemiological studies seem to indicate a slight overall increase in the relative risk of cancer, especially childhood cancer, associated with residential exposure to magnetic fields. Exposure of Drosophila and human cells was reported to show altered signal- and cell-specific patterns of transcription and translation following short cellular exposure to low-frequency [EMFs]. It appears also that the release of certain chemical species, such as $Ca^{2+}$ ions from cellular tissue, varies in a frequency-specific manner (with so-called "frequency windows") with applied AC and DC magnetic fields. The effects are observed only in certain field strength ranges (so-called "amplitude windows"), at field strengths typically several orders of magnitude lower than in the Drosophila experiments. Field-induced changes have also been reported in ornithine decarboxylase activity and protein kinase C activity, effects which have been associated with cell proliferation with possible connection to cancer promotion. There were also brief reports on electromagnetic effects in a variety of other biological systems.

On the whole, it was difficult to make a critical assessment of the available experimental evidence since no clear and reproducible pattern emerged from the results. Most groups had chosen to work on systems of widely different nature and level of complexity and although the majority of observations suggested that weak, low-frequency [EMFs] could affect biological functions, it was not always easy to relate and compare the individual studies.

Several mechanisms of interaction have been proposed, mainly focusing on the cell membrane as a possible site of action for the reported effects, for instance, the generation of coherent waves along the membrane surface. The mechanistic model based on cyclotron-like resonance of ion transport through membrane channels appeared, however, to be the only quantitatively formulated model which has been used so far to interpret the experimental results. This model is attractive in the sense that it could account for the frequency and amplitude windows as well as the experimentally observed relationship between the charge-to-mass ratio of the ion and the frequency and strength of the magnetic field. On the other hand, it has serious shortcomings with respect to the predicted magnitude of effects in biological structures, as pointed out by several workers. The region of space inside a channel, for instance, is extremely small and constrains the particle motion to such an extent that the absorption of energy in the low-frequency range was shown to be many orders of magnitude smaller than the thermal energy. This problem becomes less serious for particle paths extending over cellular dimensions, although at this macroscopic level, the frictional forces can be anticipated to be significant, and with a reasonable estimate of their magnitude, they were found to eliminate completely the resonance phenomenon.

These problems could not be resolved and instead it was argued that the search for a physical mechanism might be more fruitful if directed towards the realm of collective phenomena.

The fact that current physical-chemical models cannot provide adequate explanations of the reported observations of biological effects of [EMFs] has made this research area controversial. As a consequence, there is a reluctance among research workers to enter this debated field and the present status of the research efforts is characterized by scattered contributions, rather than the wide and systematic approach required to solve the important scientific problems concerning the effects and possible hazards of [EMFs].

In order to consolidate the experimental evidence, future research should aim at demonstrating the presence (or absence) of field effects on properties of well-characterized systems at the lowest possible level of complexity. This should facilitate replication by other independent groups and also help strengthen the link between theory and experiment. Considering the complexity and multidisciplinary nature of the problems, it is recommended that different interdisciplinary research groups coordinate their work.

Bengt Nordén
Claes Ramel

*MICROWAVE NEWS* is published bimonthly • ISSN 0275-6595 • PO Box 1799, Grand Central Station, New York, NY 10163 • (212) 517-2800 • Editor and Publisher: Louis Slesin, Ph.D.; Associate Editors: Jennifer Goren, Sarah Verdone; Contributing Editor: Mark A. Pinsky; Copy Editor: Jim Feldman; Intern: Matthew Connelly • Subscriptions: $250.00 per year ($285.00 Canada & Foreign, U.S. funds only); single copies: $50.00 • Copyright © 1989 by Louis Slesin • Reproduction in any form is forbidden without written permission.

# CLASSIFIEDS


## Announcing a New *Microwave News* Service:

### Power Line Papers

If you need to keep up with the latest news on non-ionizing radiation, we'll send you an information packet on up-to-the-minute developments every two weeks.

As a **Power Line Papers** subscriber, you will receive:

- Announcements of new studies and recent reports
- Key regulations and legislation
- News articles from all over the world
- Judicial and administrative decisions

It's the perfect complement to your *Microwave News* subscription.

**Service begins January 1990. Don't miss out!**

For ordering information, contact: Jennifer Goren, *Microwave News,* PO Box 1799, Grand Central Station, New York, NY 10163, (212) 517-2800.

## *VDT NEWS*

"Recognized for its authority on health and safety issues"
— *Fortune* Magazine

[ ] 1-year subscription (6 bimonthly issues) for $87.00 ($97.00 Canada & Foreign).

[ ] ____ back issues, 1984-1989, $45.00 per year ($50.00 Canada & Foreign).

[U.S. Funds Please]

Order from: *VDT News,* PO Box 1799, Grand Central Station, New York, NY 10163, (212) 517-2802.

Name_____
Institution_____
Address_____
City_____
State_____ Zip _____

## Order *Microwave News*

[ ] 1-year subscription (6 bimonthly issues) for $250.00 ($285.00 Canada & Foreign).

[ ] 6-month trial (3 bimonthly issues) for $130.00 ($150.00 Canada & Foreign).

[ ] ____ back issues, 1981-1989, $95.00 per year ($100.00 Canada & Foreign).

[U.S. Funds Please]

Order from: *Microwave News,* PO Box 1799, Grand Central Station, New York, NY 10163, (212) 517-2800.

Name_____
Institution_____
Address_____
City_____
State_____ Zip _____

# MICRO WAVE NEWS

Vol. X No. 6 A Report on Non-Ionizing Radiation November/December 1990


INSIDE...


## ELF NEWS pp.2-5

**The Talk of Denver**
***New Power Lines Restricted in Whatcom County, WA, and in Rhode Island***
***Reducing EMFs in Oregon***
***Prudent Avoidance in California***
***U.K.'s National Grid Funds EMF Studies***
***$1 Million Stray Voltage Award***

## HIGHLIGHTS pp.5-9

***Two RF/MW Liability Suits Filed***
***Excerpts from EPA EMF Report***
***USAF Blasts EPA Report***
***USAF Letter-Writing Campaign***
***CIRRPC To Review EMF Health Effects***
***White House Recommends EMF Experts***

## NEW PUBLICATIONS pp.12-13

***Books and Reports: Annotated Listings***

## UPDATES pp.9-11

***USAF OKs PAVE PAWS Modification • EPRI Workshops on Epidemiology and Dosimetry • Adey on EMF-Chemical Synergy • NRC's GWEN Committee • Two Medical EMF Patents Granted • MWs and Leukemia Debated • People in the News • MW Coffee and Cookies • MW Popcorn Hazards • More from Paul Brodeur • "Macworld" Goes to Washington • MW Ovens in "Consumer Reports" • and more...***

## CONFERENCES pp.14-15

***1991 Conference Calendar***

## CLASSIFIEDS p.16


# White House Sets Conditions for Release of EPA Cancer Report

## Expert Panel's Assessment Delayed

The public release of the Environmental Protection Agency's (EPA) draft assessment of electromagnetic fields (EMFs) and cancer has been delayed following strong objections from the White House and from the U.S. Air Force. In addition, the formal review of the EPA report by the agency's Science Advisory Board (SAB) will not be concluded until a new evaluation has been completed.

On November 26, a day before the draft report was scheduled to be released, Dr. Allan Bromley, the President's science advisor, asked senior EPA officials not to issue the report pending another review by the Committee on Interagency Radiation Research and Policy Coordination (CIRRPC), according to knowledgeable sources. CIRRPC is an offshoot of the White House Office of Science and Technology Policy (OSTP), which is headed by Bromley.

Under a compromise worked out between the White House and EPA, the agency will hold up the public release of the cancer assessment until late December and the SAB panel will review the CIRRPC report when it is completed. The CIRRPC review group is still in formation and is not expected to begin work until January. Its report will take a minimum of six months to be completed—almost certainly longer (see story on p.8).

David Cohen, a spokesman in the office of EPA Administrator William Reilly, confirmed that there had been "negotiations" with the White House. "We felt it was a fair request," he said, referring to the White House's insistence on waiting for the CIRRPC review. Sources indicated that Reilly

*(continued on p.6)*

# Some Hand-Held Two-Way Radios May Present Health Risk

Computer calculations indicate that hand-held two-way radios can emit radiation levels that exceed health standards. They also call into question the advisability of the exemption for devices with an input power of seven watts (7 W) or less, which is included in many health guidelines.

At last summer's Bioelectromagnetics Society (BEMS) meeting in San Antonio, TX, Dr. Niels Kuster of the Swiss Federal Institute of Technology in Zurich and Dr. Quirino Balzano of Motorola, Inc. in Plantation, FL, reported that their computer models indicate that a 7 W radiation source operating at frequencies above 400 MHz would deposit more than 8 W/Kg in human tissue at a distance of 2.5 cm. At 800-900 MHz, a frequency used

*(continued on p.11)*

# ELF NEWS

## The Talk of Denver

This year's DOE power line review* offered few surprises. There were no bombshells in Denver, CO, as compared to Dr. Gene Matanoski's revelations at last year's meeting in Portland, OR. If there was one lesson to take home from Denver, it was that the electromagnetic field (EMF) problem remains elusive, with no agreement yet on the most important aspect of EMF exposures. To be specific, what is it about the magnetic field that could promote cancer? And are the epidemiologists measuring the right parameters in their attempts to estimate EMF exposures?

The thesis that the pineal gland is sensitive to EMFs got a boost from preliminary data indicating a suppression of nighttime melatonin levels among two species exposed to power line fields. Dr. Fred Stormshak of Oregon State University in Corvallis reported that ewes living under a 500 kV power line—with ambient magnetic fields of 15–50 mG and electric fields of 4–7.5 kV—had a 20–25% reduction in serum melatonin.

Outside the lecture hall, there was talk of even larger reductions among baboons exposed to 60 Hz EMFs at the Southwest Research Institute (SWRI) in San Antonio, TX. SWRI's Dr. Walter Rogers did not formally present these results and refused to discuss them. "I'm not going to talk to you about this. The information belongs to the sponsors," Rogers told *Microwave News* as he walked away from an interview.

The SWRI project is primarily funded by the Central Research Institute of Electric Power Industry (CRIEPI) in Tokyo, Japan. Izumi Nishimura of CRIEPI's Abiko Research Laboratory also declined to discuss the experiment, saying only that there were no results yet.

Dr. Bary Wilson, who, with other members of the Battelle group in Richland, WA, has been working on the pineal–EMF link for over a decade, reported that intermittent exposures to magnetic fields are more effective than continuous exposures in reducing nighttime melatonin in rats.

The importance of intermittent exposures was a thread that ran through many of the talks. Dr. Russel Reiter of the University of Texas Health Science Center in San Antonio presented results suggesting that the on-and-off switching of a magnetic field is a key parameter for explaining observed changes in pineal function (see *MWN*, S/O90). And Dr. Charles Graham of the Midwest Research Institute in Kansas City, MO, reported that he observed the greatest physiological effects among humans exposed to EMFs immediately after the field was turned on and immediately after it was turned off. Like Wilson, Graham concluded that "intermittent exposure may be more biologically active than constant exposures."

These results support those presented some years ago by Drs. Craig Byus of the University of California, Riverside, and Ross Adey of the VA Hospital in Loma Linda, CA, who observed similar trends in their experiments with ornithine decarboxylase (see *MWN*, J/A83 and N/D87).

Intermittent exposures can result from moving in and out of an EMF or from being exposed to a source that switches on and off. Each entails a different type of exposure. Moving in and out of the field may tax the body's homeostatic power to acclimate to new electromagnetic environments. An EMF source that switches on and off, such as an electric blanket, generates EMF pulses that result in exposures not only to extremely low frequency (ELF) fields but to high frequency radiation as well.

Wilson verbalized what was on many people's minds when he advised that, from now on, EMF exposure systems and assessments should include any transient or high frequency components, as well as absolute field strengths.

Dr. Nancy Wertheimer and Ed Leeper, who are based in Boulder, CO, highlighted the importance of another new variable in gauging EMF exposures—the direction of the magnetic field. By adding this information to Dr. David Savitz's childhood data set and Dr. Richard Stevens's adult data set—the two epidemiological studies sponsored by the New York State Power Lines Project (see *MWN*, N/D86)—they found higher risk ratios than were originally reported.

Wertheimer and Leeper stressed that average magnetic fields inclined at less than 60° from the horizontal "may prove to be an index to something else that can be more directly or meaningfully related to cancer risk." For instance, these types of ambient EMFs may often be due to ground currents, which can vary considerably over time, and, as Wertheimer pointed out to *Microwave News*, they might point once again to the importance of intermittent exposures.

A group from the California Department of Health Services in Berkeley also concluded that Savitz had probably underestimated the risk of cancer from EMFs by using spot measurements and wire codes as surrogates for magnetic field exposures. Christianna Williams and coworkers measured EMFs in the San Francisco bay area and compared them to the exposures indicated by the surrogate indices. Williams's pilot study showed that there was probably "considerable misclassification," leading to a conclusion of a smaller cancer risk than would have been observed with more complete exposure information.

The California group will take a more detailed look at how misclassification of exposures can bias risk estimates when they send a team to do measurements in Denver, the site of the original Wertheimer-Leeper and Savitz studies (see *MWN*, J/A89).

Dr. Susan Preston-Martin of the University of Southern California (USC) in Los Angeles also raised the possibility that EMF cancer risks could turn out to be higher than previously believed. She announced that the incidence of astrocytomas (brain tumors) among males occupationally exposed for more than ten years was more than ten times the expected rate; in an earlier published analysis, Preston-Martin had reported a fourfold increased risk after more than five years of EMF exposure (see *MWN*, M/A90). Her finding closely parallels that of Dr. Terry

**The Annual Review of Research on Biological Effects of 50 and 60 Hz Electric and Magnetic Fields*, Denver, CO, November 5-8, 1990. Organized by the U.S. Department of Energy (DOE); cosponsored by the American Public Power Association and the Edison Electric Institute.

Thomas, who found a more than tenfold increase among workers exposed on-the-job for 20 years (see *MWN*, S/O87). Preston-Martin noted that neither soldering nor solvents could account for the increased tumor risk.

The Denver meeting was the first in many years not to be cosponsored by the Electric Power Research Institute (EPRI), but there are indications that the divorce is not working out (see *MWN*, N/D89). Some attendees were disappointed by the absence of many of the EPRI researchers. And those who had been at the EPRI utility meeting a few weeks earlier in Austin, TX, reported that there was some grumbling because of the lack of new results.

There had been suggestions that USC's Dr. John Peters would report on his EMF–childhood cancer study in Austin. He didn't; neither did he attend the Denver meeting. The delay encouraged speculation about what the results might show—especially when those who had been in Austin reported that Peters, when confronted with the perennial question "Would you buy a home next to a power line?" answered that he might, but only if he did not have young children. Some observers were quick to interpret the answer as a clear indication that Peters, like Savitz, had confirmed the original Wertheimer-Leeper EMF link.

When later asked by *Microwave News* if there was any substance to this line of argument, Peters replied with an amused "No." He did say that he hopes to have his results ready for the EPRI epidemiology workshop in February (see p.9).

In an interview with *Microwave News* after the Denver meeting, EPRI's Dr. Leonard Sagan left open the possibility that EPRI will rejoin the annual review. "My preference is that all the participating agencies sponsor the EMF review, including the National Cancer Institute, the National Institute for Occupational Safety and Health and the Environmental Protection Agency," he said.

Despite all the new attention to EMFs over the last year, funding levels have not increased—not even for the study of pineal effects, which many think is the key to finding a mechanism of interaction. "It's really been tough," Reiter said in an interview. "Frankly, I am discouraged by the lack of funding"—he explained that he has yet to receive "a single penny" for EMF research and that he had come to Denver at his own expense. Reiter said that if he had some money, he would work on defining those parameters of the field that are important and the mechanisms involved.

# New Power Lines Restricted in Washington and Rhode Island

Unprecedented power line siting restrictions have been imposed on both coasts. In November, Whatcom County, WA, voters chose to confine new power lines above 115 kV to industrially zoned areas, and in October, the East Greenwich, RI, town council passed a three-year moratorium on new lines above 60 kV. In both cases local citizens' groups called for the restrictions in response to utility proposals for new lines.

If the trend towards regulating power lines on a local level continues to gain momentum, it could become a problem for the utility industry, according to Richard Loughery, manager of environmental programs at the Edison Electric Institute in Washington, DC. "We would prefer a single state standard. Potentially it could become a nightmare if we have a multitude of local standards to deal with," Loughery told *Microwave News*. Several states have imposed electromagnetic field (EMF) limits for the edge of utility right-of-ways (ROWs), and during the most recent session of congress, Rep. Frank Pallone (D-NJ) discussed a national EMF limit for ROWs (see *MWN*, M/A90 and J/A90).

*MICROWAVE NEWS* is published bimonthly • ISSN 0275-6595 • PO Box 1799, Grand Central Station, New York, NY 10163 • (212) 517-2800; FAX (212) 734-0316 • Editor and Publisher: Louis Slesin, PhD; Senior Editor: Jennifer Goren; Assistant Editors: Matthew Connelly, Barton Biggs; Contributing Editor: Mark A. Pinsky; Copy Editors: Jim Feldman, Peter Pullman; Circulation Director: Barbara Gerson • Subscriptions: $250.00 per year ($285.00 Canada & Foreign, U.S. funds only); single copies: $50.00 • Copyright © 1990 by Louis Slesin • Reproduction in any form is forbidden without written permission.

### Ballot Initiative in Washington

Voters in Whatcom County, WA, approved a citizens' initiative restricting power lines exceeding 115 kV to industrial areas. Citizens Initiative No.4-90 marks the first successful power line siting referendum in the U.S. The immediate effect will be to disrupt Puget Power & Light Company plans to build two new 230 kV transmission lines to carry hydroelectric power from Canada.

The measure could be overturned in court because county laws forbid zoning by initiative. No challenge is expected, however. "You won't see us in court filing suit over this issue anytime soon," Puget Power representative Jude Noland told *Microwave News*.

"People are telling us something," said County Planning Director Dan Taylor, adding that, "No matter how the measure fares in court, there is a message there that we have to pay attention to."

The Whatcom County vote stood out in a year in which many other environmental referendums were rejected. California's "Big Green" and New York's environmental bond propositions both failed, yet the Whatcom County power line initiative passed by a nearly two-to-one margin.

Before the election, Bellingham Neighbors Opposing Power Encroachment (NOPE) successfully persuaded Puget Power to run the northern parts of the lines through an existing Bonneville Power Authority (BPA) right-of-way rather than create a new corridor near a number of homes. But NOPE continued to object to Puget Power's intention to run the rest of the lines through

heavily populated areas of Bellingham, and is using the initiative to force the utility to employ the existing BPA corridor for the rest of the lines as well. NOPE collected over 6,000 signatures to qualify the measure for the November ballot.

Puget Power allocated $100,000 to fight the NOPE initiative. Noland said that the utility is currently considering a number of alternatives to the lines.

### Three-Year Moratorium in Rhode Island

On October 9 the town council of East Greenwich, RI, banned all new power lines above 60 kV for three years. The ordinance came about in response to widespread citizen concern about the EMFs from proposed new 345 kV and 115 kV lines which the Narragansett Electric Company plans to run through parts of East Greenwich. This is the first moratorium on power line construction in the U.S.

Narragansett Electric has appealed the decision to the Rhode Island Public Utilities Commission (PUC), contending that the 345 kV line is needed by 1994 and that the three-year moratorium could prevent it from adequately providing power to western Rhode Island.

Public concern over power line safety had previously prompted Governor Edward DiPrete to set up a committee—headed by PUC Chairman James Malachowski—to study EMF health effects. An interim report, issued in September, recommended further study and a policy of prudent avoidance to limit exposures.

## Reducing EMFs in Oregon

Pacific Power and Light, an Oregon utility, recently announced that it will use a "delta" tower design that will nearly halve the EMF levels along the edge of the right-of-way (ROW) of a proposed 500 kV power line.

The total additional cost of the new towers is approximately $2.4 million, about 3.5% of the total cost of the project.

David Stewart-Smith of the Oregon Department of Energy (DOE) told *Microwave News* that the new delta design will reduce levels at the edge of the ROW to 30–35 mG, down from the earlier estimates of 56 mG for the original "flat" tower design. Electric field levels will also be almost halved. The new towers will be 20 feet taller than those originally planned.

Puget Power, which received a permit to build the 130-mile Eugene–Medford line in 1982, hit a roadblock when residents living near the proposed line banded together to fight the utility's plans. The ensuing controversy led the DOE to assemble a panel of experts to review the literature on ELF health effects (see p.13).

On October 26, the state Energy Facility Siting Council unanimously approved the utility's proposed changes for the line, which also include a one-year extension of the site certificate deadline to December 31, 1994.

## Prudent Avoidance in California

The California Public Utilities Commission (PUC) has ordered the Southern California Edison Company (SCE) to follow a policy of "prudent avoidance" to limit EMFs from a proposed 220 kV power line in the Mojave Desert. The PUC also mandated that SCE provide those living, working and playing near the new line's right-of-way with literature on EMF health risks, but did not specify a source for the written material.

The proposed 38-mile line is expected to cost over $50 million and to be in operation by late 1992. In its September 12 decision, the PUC advised caution with regard to EMFs, stating that, "All that is certain is that we do not know enough to dismiss the issue entirely....until the scientific findings are more definitive, we will require SCE to take responsible, low-cost steps to avoid unnecessarily exposing people to these fields."

Rhode Islanders for Safe Power (RISP) pushed for the three-year moratorium because of the need for further research on the health effects of EMFs and because it "was the least noxious formula and the most likely to be sustained by the PUC," RISP's Ed Seiler told *Microwave News*. If the moratorium is overturned, RISP may request the town council to order the more expensive alternative of burying the lines, Seiler said.

In an interview, Narragansett Electric spokesman Charles Moran said that the company has not started to develop an alternative route for the $44 million 345 kV project and is counting on the PUC to overturn the moratorium. Moran said that EMF levels at the edge of the ROW of the 345 kV line would not exceed 20 mG.

RISP, which was formed in January 1990, has some 300 members. RISP President Jeff Jacober and East Greenwich Town Solicitor Daniel Procaccini described RISP's work at the power line congressional hearing last July (see *MWN*, J/A90).

## U.K.'s National Grid Funds EMF Cellular Studies

The U.K.'s National Grid Company has awarded six contracts to British universities and research institutes to study the effects of power frequency electromagnetic fields (EMFs) on cellular interactions. The total amount of the contracts, which will run for two or three years, is about £600,000 (approximately $1.2 million).

The National Grid Company, one of the four successor companies to the Central Electricity Generating Board (CEGB), which was dissolved in March 1990, is responsible for the transmission of electric power in England and Wales. (Distribution is the responsibility of regional electricity companies.) It has also taken charge of the CEGB's EMF research program.

The projects—which were selected by an independent steering committee chaired by Dr. Charles Suckling, a member

of the Royal Commission on Environmental Pollution and formerly a general manager of research and technology at ICI, plc—are as follows:

- *"The Effects of Low Frequency EMFs on Cellular Transcription in Sciara and Drosophila Salivary Glands"*—Drs. M. Anderson and A.J. Birley, School of Biological Sciences, University of Birmingham;
- *"Rapid Biochemical Responses in Cultured Cells to Power Frequency EMFs"*—Drs. J.C. Metcalfe and T.R. Hesketh, Department of Biochemistry, University of Cambridge;
- *"Effects of Low Frequency Magnetic Fields on Single Ion Channels"*—Dr. S.B. Hladky, Department of Pharmacology, University of Cambridge;
- *"Effects of Low Frequency Alternating Magnetic Fields on Short-Term Responses of Haemopoietic Stem and Progenitor Cells to Specific Growth Factors"*—Prof. T.M. Dexter and Dr. R.E. Dale, Paterson Institute for Cancer Research, Manchester;
- *"The Uptake of $Ca^{++}$ in a Frequency Dependent or 'Resonant' Manner as Indicated by Changes in the Mobility of Diatom Strains Sensitive to the $Ca^{++}$ Concentration in Their Support Medium"*—Dr. R. Dixey, St. Bartholomew's Hospital, London, and Dr. J.C. Green, Plymouth Marine Laboratory;
- *"Influence of Low Frequency EMFs on Ion Flux Through Reconstituted Membrane Channels"*—Prof. R. Pethig and Dr. H. Morgan, Institute of Molecular and Biomolecular Electronics, University College of North Wales, Bangor.

The National Grid Company is also funding in-house exposure assessments. In 1988, the CEGB launched a major epidemiological initiative to study new diagnosed childhood cancer cases in England and Wales (see *MWN*, M/A88). Results of two EMF–childhood cancer studies at the University of Leeds (see *MWN*, N/D89) are expected to appear in the *British Journal of Cancer* "in due course," according to a company spokesman.

## $1 Million Stray Voltage Award; Major Study in Wisconsin

A jury in Minnesota has awarded $1 million to a family of dairy farmers who contended that their cows' milk production was substantially decreased by stray electrical voltage. On October 9, after a two-and-a-half-week trial in the Sibley County District Court, the jury agreed with Dale ZumBerge and his family that Northern States Power (NSP) Company had been negligent in not correcting a 13-year chronic stray voltage problem.

The utility has filed a posttrial motion objecting to a number of aspects of the case. The stray voltage levels at the ZumBerge farm "could not have had an impact on dairy production," NSP attorney Jim Altman told *Microwave News*.

The return wire of the ZumBerges' distribution system was the source of the problem, James Kaster, the family's Minneapolis, MN-based attorney, said in a telephone interview. Readings inside the family's barn were as high as 2.5 V in 1984. Subsequent complaints by the ZumBerges prompted NSP to attempt to eliminate the stray voltage. Yet the levels were still 1.5 V in 1987 and 1 V in 1989, according to Kaster.

In neighboring Wisconsin, the state Public Utilities Commission (PUC) is initiating an ambitious study of the effects of the electrical environment on dairy livestock. Stray Voltage Analysis Team leader Daniel Dasho told *Microwave News* that the study will "look beyond the normal stray voltage problem" by examining the individual and combined effects of electromagnetic fields (EMFs), ground currents and direct currents. Dasho added that, in light of the international attention being paid to the EMF issue, the Wisconsin PUC wants to contribute to the "nationwide information base."

# HIGHLIGHTS

## Two Cancer Victims File Suit Against RF/MW Companies

In separate actions in October, two men who claim that they developed cancer from exposure to radiofrequency and microwave (RF/MW) radiation filed $25 million product liability suits in New York against the equipment manufacturers and operators. Thomas Ford, a former U.S. Navy radar technician, claims that exposure to shipboard radars caused him to develop chronic health problems and, ultimately, non-Hodgkin's lymphoma (NHL). Michael Dowgiallo, an electrician, alleges that acute exposure to RF/MW radiation caused his stomach cancer.

Ford and Dowgiallo are represented by John Sweeney of Sweeney & Pafundi in Agoura Hills, CA. Sweeney has handled other RF/MW cases in the past, including that of a former Navy radar technician with cataracts who received a $131,000 settlement in 1988 (see *MWN*, M/A88). Kenneth Henrie of Henrie & O'Boyle in Wantagh, NY, is serving as Sweeney's local counsel.

In a telephone interview, Sweeney predicted that there will be more and more litigation, noting that "there is a growing awareness that electromagnetic fields (EMFs) are connected to cancer."

### Radar Exposure off the Vietnam Coast

Thomas Ford served aboard a Navy destroyer between 1965 and 1967. According to his wife, Kathy, who is a co-plaintiff, Ford was positioned directly beneath the ship's main navigational radar units and in front of the gun control radar unit for an average of 16 hours a day. For a period of six months when his ship was on maneuvers off the coast of Vietnam, the gun control radar was on almost all the time.

Two years after his discharge from the Navy, Ford began to show signs of immune system impairment. In 1988, at the age of 41, he was diagnosed with NHL. Ford was denied a "service-connected" disability claim from the Veterans Administration (VA) in 1989 on the ground that, "There is no scientific evidence to suggest a link between non-ionizing radiation exposure from

radar and cancer."

This year, however, the VA announced that it will honor all NHL-related disability claims from Vietnam veterans—following the March 1990 release of a Centers for Disease Control study showing that Vietnam veterans are at an increased risk for NHL. Those serving on ships off the Vietnam coast have the highest risk, according to the report. Kathy Ford expects her husband's claim will now be approved, but the Fords have not yet received official notification.

Ford's legal complaint, which was served on October 17, names AT&T, GE, Raytheon, GTE Products Corp. and Lockheed, all makers of shipboard radars for the Navy, as defendants.

Sweeney expects that the defendants will try to use the military contractors' defense authorized by a 1988 U.S. Supreme Court decision, *Boyle v. United Technologies*, but he believes that the case is "clearly outside the limits of the doctrine," primarily due to the contractors' failure to warn the government of the real risks involved.

"I have no doubt of the causal relationship between Ford's exposure and his illness. He had a particularly intense exposure, unusual even for a military man," Sweeney told *Microwave News*.

### Atop the Chrysler Building

For several months in 1980, Michael Dowgiallo installed lights on the exterior of the tower of the Chrysler Building in New York City. During that time, Dowgiallo claims that he was exposed to high levels of RF/MW radiation from FM antennas and MW transmitters, often just a few inches away from him.

Dowgiallo's supervisor had expressed concerns about the safety of working near the RF/MW transmitters, according to Dowgiallo, but was subsequently assured by Eastern Communications of Long Island City, NY, the owner of the equipment, that the transmitters posed no hazard to workers. In a December 15, 1980 letter to JKC Realty, the owner of the Chrysler Building, however, Eastern stated that its antennas were "HOT" and could be "considered dangerous up to a ten-foot radius" and that, "Exposure to this type of radiation at a distance of less than eight to ten feet for protracted periods of time may have effects that will not show up for years."

In 1979, an employee collapsed while working near FM transmitting equipment on the 77th floor of the Chrysler Building. The Occupational Safety and Health Administration (OSHA) did an RF survey and found a maximum level of 2.5 mW/cm$^2$ about six feet from an antenna element. OSHA concluded—based on its then current standards—that workers inside the building were not at risk from excessive RF exposure, but recommended that workers not be allowed within six feet of the radiating antenna element.

Dowgiallo was diagnosed with stomach cancer in 1988 at the age of 39. Although it has not typically been linked to EMF exposures, Dr. Genevieve Matanoski of Johns Hopkins University reported in 1989 four cases of stomach cancer among approximately 9,000 New York Telephone Co. central office technicians (who were exposed to complex EMFs), where none were expected (see *MWN*, N/D89).

Dowgiallo's complaint was served on October 25. Dowgiallo and his wife Sharon name JKC Realty, Eastern Communications, the International Brotherhood of Electrical Workers Local No.3 and Robert B. Samuels, Inc. (his employer) as defendants. They have also filed a workers' compensation claim.

For more on RF/MW litigation, see *MWN*, D82, J/F83, Jn84, My85, S/O85, J/F86, M/J86, S/O86, M/A88, M/J89 and S/O89.

### White House Holds Up EPA Report (continued from p.1)

himself was involved in the negotiations.

An earlier draft of the EPA report, *Evaluation of the Potential Carcinogenicity of Electromagnetic Fields*, released last June, concluded that studies of extremely low frequency (ELF) EMFs and leukemia, lymphoma and brain cancer among children and workers "show a consistent pattern of response that suggests, but does not prove, a causal link" (see *MWN*, M/J90). The report attracted widespread public interest when *Microwave News* reported that EPA staffers had recommended that ELF EMFs be classified as "probable human carcinogens" and radiofrequency and microwave radiation be classified as "possible human carcinogens." The report was issued without any classifications following a March meeting at the White House.

The forthcoming draft of the EPA report—called the "external review draft"—also does not include any classifications of the carcinogenicity of EMFs because of "uncertainties" about the mechanism of interaction. The draft concludes that epidemiological studies "show a consistent pattern of response which suggests a causal link" (see p.7 for excerpts).

Three EPA officials attended the November 26 meeting at the White House: Drs. Erich Bretthauer, the assistant administrator for research and development, William Farland, the director of the Office of Health and Environmental Assessment (OHEA) and Robert McGaughy, the lead author of the document. Bretthauer refused to be interviewed by *Microwave News*, Farland did not respond to phone calls and McGaughy said that he could not comment on the meeting.

Calls to Bromley's office were referred to OSTP's Dr. Kenneth Yale, who did not answer requests for comment.

The White House request for EPA to wait for the CIRRPC review follows a similar request from the Air Force (see p.7). In an October 2 letter to EPA, Brigadier General Paul Gleason of the Office of the Air Force Surgeon General opposed publication of the EPA report until both the CIRRPC review and an analysis by the National Research Council of the Air Force's Ground Wave Emergency Network (see p.9) are completed.

Gleason's letter accompanied a 33-page blistering critique of the EPA report which charges the authors with having "biased the entire document toward EMF-induced carcinogenicity." The Air Force concludes that, "It is astonishing that the

## Excerpts from EPA's EMF Report

*The following is excerpted from the Executive Summary of the forthcoming external review draft of EPA's report,* Evaluation of the Potential Carcinogenicity of Electromagnetic Fields, *dated October 1990 and obtained by* Microwave News *in November.*

In conclusion, 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 which suggests a causal link....

At this time, such a characterization regarding the link between cancer and exposure to EMFs is not appropriate because the nature of the interaction between EMFs and biological processes leading to cancer is not understood....

Because of these uncertainties, it would be inappropriate at this time to classify the carcinogenicity of EMFs in the same way as the agency does for chemical carcinogens....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 humans....

U.S. EPA would place its imprimatur on this report."

Gleason stated that, "If published, the report will contribute to needless public anxiety, and have serious impacts on capabilities and costs of Air Force programs."

The SAB will assemble a panel of experts to review the draft report at a public meeting in the Washington area on January 14-15 and, if necessary, January 16 (if the release of the report is not delayed further). Dr. Genevieve Matanoski of the Johns Hopkins University School of Hygiene and Public Health in Baltimore, MD, will chair the SAB's Non-Ionizing Electric and Magnetic Fields Subcommittee of the Radiation Advisory Committee. Dr. David Bates of Vancouver, Canada, will be the vice chairman.

Kathleen Conway, the SAB staff officer responsible for the review, told *Microwave News* that there will be as many as 18 experts on the panel. At press time, the selection process had not yet been completed.

Conway said that she had received numerous nominations for membership on the panel. For example, she said that EPA had been sent recommendations from the Edison Electric Institute, the Electric Power Research Institute, the White House (see p.8) and Crowell & Moring, a Washington, DC, law firm which has represented a number of utilities in power line siting battles. "We considered over 200 experts," Conway said.

The SAB is being cautious about the makeup of the EMF panel because of the attention being paid to another SAB committee, which is investigating the health risks of environmental (passive) tobacco smoke. A number of the members of that committee are consultants to the cigarette industry and EPA came close to removing one antismoking advocate from the panel after complaints from the Tobacco Institute.

Copies of EPA's draft report will be available from: Dr. Robert McGaughy, [RD-689], OHEA, EPA, 401 M St., SW, Washington, DC 20460, (202) 382-5898.

## U.S. Air Force Labels EPA Report Biased and Political

The October 2 Air Force review of the Environmental Protection Agency (EPA) cancer assessment document—prepared by a team of "radiofrequency (RF) effects scientists" led by Drs. David Erwin and James Merritt at the Brooks Air Force Base School of Aerospace Medicine, TX—begins with a quote from the Roman historian Tacitus: "Some believe all manner of hearsay evidence; others twist truth into fiction; and both sorts of error are magnified by time." The Air Force argues that the EPA authors present "no evidence of causation between electromagnetic fields (EMFs) and cancer, but rather argue as if this hypothesis were accepted fact."

The Air Force claims that the authors "consistently neglect the majority of negative studies and concentrate most of their discussion on weak positives of dubious value." Blasting the report's statements on the "consistency" of the evidence and on the need for more research, the Air Force charges that "these are political statements and not scientifically derived conclusions."

"Our reviewers of this document are convinced that there is no suggestion that EMFs present in the environment today induce or promote cancer," the Air Force concludes.

The Air Force dismisses the report's section on extremely low frequency (ELF) epidemiological studies, claiming that, "The overall weight of epidemiologic evidence is so slight as to be almost nonexistent; certainly not sufficient to justify further large expenditures of scarce research resources."

With regard to the report's survey of animal studies, the Air Force argues that any credible effects are most likely due to heat-induced stress, rather than to "some other property of RF radiation." The Air Force even suggests that ELF effects on the pineal gland are heat-related.

In contrast to most EMF researchers, government officials and industry representatives, the Air Force maintains that, "In general, there is sufficient research being carried out in various laboratories commensurate with the urgency of the problem."

## Letter-Writing Campaign

One member of the Air Force team that wrote the report appears to be on a one-man crusade to correct what he perceives as published errors about EMFs. Dr. James Jauchem has had a flurry of letters published in popular and scientific journals—for instance, *Nature* (October 4), *The Lancet* (October 6), *The Bulletin of the Atomic Scientists* (November 1990), *Science* (November 9) and the *British Journal of Haematology* (see p.9). In general, Jauchem criticizes the "lay media" for providing "misinformation on the alleged hazards of EMFs." Not surprisingly, his statements closely parallel some of the arguments presented in the Air Force review of the EPA cancer assessment. Jauchem, a research physiologist, has written a number of papers in recent years on the thermal effects of RF radiation.

## Interagency Panel Asks for New EMF Health Review

The Committee on Interagency Radiation Research and Policy Coordination (CIRRPC), an offshoot of the White House Office of Science and Technology Policy, is undertaking a new review of electromagnetic field (EMF) health effects.

A new subpanel on the health effects of EMFs is being chaired by Dr. Robert McGaughy of the Environmental Protection Agency (EPA), the lead author of EPA's EMF cancer assessment (see p.1 and *MWN*, M/J90). In an interview with *Microwave News*, McGaughy said that the subpanel has been asked to assemble "an authoritative review of the health effects of low frequency EMFs"—at both power line (15–180 Hz) and VDT (10–30 kHz) frequencies—"to guide federal agencies on what should be done about this problem."

One of the panel's first decisions was to commission a literature review by an outside group of experts. Dr. Charles Susskind of the University of California, Berkeley, will chair the review group. McGaughy noted that Susskind's survey will include not only cancer but also central nervous system, reproductive and developmental effects. Susskind is also a member of EPA's Science Advisory Board.

## White House Recommendations to EPA on EMF Experts

*Reprinted below is a memorandum from Dr. Allan Bromley, President Bush's science advisor, to William Reilly, the administrator of the Environmental Protection Agency (EPA). No attempt has been made to correct any of Bromley's errors of fact—for instance, Dr. Toler is in the midst of a major study of microwave effects on mice—not ELF effects on rats.*

*Bob Adair, referred to by Bromley, is Dr. Robert Adair, a professor of physics at Yale University and an outspoken skeptic about ELF field effects (see* MWN, *J/F90 and M/J90). Before moving to Washington, DC, Bromley was also a Yale physics professor.*

THE WHITE HOUSE
WASHINGTON

August 2, 1990

Memorandum for the Honorable William K. Reilly
From: D. Allan Bromley
Subject: ELF Studies

As promised, I am sending you herewith a list of people whom I would recommend as persons whom you might consider as very knowledgeable ones in the area of alleged non-ionizing, non-thermal biological effects of low intensity, low frequency electromagnetic radiation. They cover a wide range of age, experience, background, etc.

I also enclose, to keep your file of Adair papers up-to-date, a recent comment regarding alleged biological effects of static magnetic fields. Bob Adair is also someone whom you might want to keep in mind. He is very bright, uninhibited and someone who can be abrasive when he feels that the situation deserves it.

This is a very difficult area that I am sure you agree requires careful treatment if we are to serve the public well.

### Some Good People for ELF Studies

*A.W. (Bill) Guy* (about 60), Prof. of Electrical Engineering and Bioengineering, University of Washington, Seattle. Guy is very competent, very low-key, highly respected in the field. Formerly president of the Bioelectromagnetics Society, second awardee of their D'Arsonval Medal. Expert on antenna theory, microwaves, etc., especially energy depositions of microwaves in humans. Guy was PI in an extensive study funded by the Air Force (School of Aerospace Medicine, Brooks Air Force Base, San Antonio) of effects of microwaves on rats where rats were exposed for their lifetimes—one and two years—and about 150 biological endpoints were measured.

*Kenneth Foster* (about 35), Associate Prof. of Bioengineering, University of Pennsylvania. Foster is a very bright, very sound, younger biophysicist specializing in the electrical properties of biological materials—especially at the cellular level. (I believe that his PhD is in physics.)

*William Pickard* (about 50), Prof. of Electrical Engineering at Washington University, St. Louis. Pickard has made substantial contributions to our knowledge of the electrical properties of biological materials, experimental and theoretical. Bill is a Harvard PhD in applied physics and is very bright and very sound. (Pickard and Foster wrote a *Scientific American* article to the effect that there are no significant biological effects from low intensity microwaves.)

*John deLorge* (about 50), Naval Aerospace Medical Research Laboratory, Pensacola, Florida. Psychologist, radiation effects on primates. Director of programs, alternate to Skip Kerschner on CIRRPC committee [see above].

*W. Gregory Lotz* (about 38), NAMRL, Pensacola, Florida. Endocrinologist who works with whole animals, primates, etc. Conducted excellent ELF study on rhesus monkeys. Intelligent and sensible, very able.

*John Bergeron* (about 55), General Electric. Biophysicist, very good.

*Herman Schwan* (72), Prof. Emeritus Department of Bioengineering, University of Rochester, member National Academy of Engineering. Almost father of the field in the U.S.

*Sol M. Michaelson* (about 65), Prof. Dept. of Radiation Biology and Biophysics, University of Rochester. A grand old man of the field.

*Mort Miller* (about 40), Prof. Radiation Biology and Biophysics, University of Rochester. Biophysics with emphasis on biology. Very good.

*E.L. Carstenson*, Prof. Electrical Engineering, University of Rochester. Has written decent semipopular book on effects of ambient electromagnetic fields.

*Eleanor Adair*, Fellow John B. Pierce Foundation, New Haven. Ellie has some interesting capabilities concerning the effects of magnetic fields on primates.

*Allan Grodzinski*, MIT. Was funded by Air Force (but they ran out of money). Good man with excellent research facilities.

*James Toler*, Georgia Tech. Funded by Air Force to conduct major study of ELF fields on rats.

In a telephone interview, Susskind said that he is working with McGaughy's subpanel in selecting the other members of his committee, which he hopes to assemble by January. McGaughy would like Susskind's report in six months. "The federal agencies want this report pretty fast," McGaughy said. When asked about the schedule, Susskind would only say that, "We will try to complete the report during 1991."

This is the second time CIRRPC has commissioned a review on non-ionizing radiation. In 1985, Dr. Ross Adey of the VA Hospital in Loma Linda, CA, was asked to review the current state of knowledge (see *MWN*, N/D85), but CIRRPC later refused to release his report. In a July 24, 1990 memorandum, Dr. Alvin Young of the Department of Agriculture, the chairman of CIRRPC, noted that Adey's report was not published "because of its lack of balance," with too much emphasis placed on non-thermal effects. In 1987, Adey included many of the recommendations from his draft CIRRPC report in his testimony before a congressional subcommittee (see *MWN*, N/D87).

The other members of the CIRRPC subpanel are: Dr. Imre Gyuk of the Department of Energy; Dr. Charlotte Silverman and John Monahan of the Food and Drug Administration; Dr. Sheldon Weiner of the Occupational Safety and Health Administration; and Lt. Commander H.F. Kerschner of the U.S. Navy, representing the Department of Defense. According to McGaughy, Weiner originally requested the new EMF review.

# UPDATES

## BIOLOGICAL EFFECTS

**EMF–Chemical Synergy...**"Bioelectromagnetic research reveals clear evidence of joint actions at cell membranes of chemical cancer promoters and environmental electromagnetic fields. The union of these two disciplines has resulted in the first major new approach to tumor formation in 75 years...," according to Dr. Ross Adey of the VA Medical Center in Loma Linda, CA. Reviewing current research on the bioeffects of ELF fields and RF/MW-modulated radiation—with a special emphasis on cell membrane interactions—Adey argues that it is "increasingly clear" that EMFs acting alone or with chemical environmental pollutants "may constitute a potential health hazard," and that "it is of paramount importance that the significance of these issues no longer be ignored." See "Joint Actions of Environmental Non-Ionizing Electromagnetic Fields and Chemical Pollution in Cancer Promotion," *Environmental Health Perspectives, 86*, pp.297-305, 1990.

**MWs and Leukemia Debated...**Two recent letters in the *British Journal of Haematology* question the conclusions of a case report on acute leukemia following exposure to MW radiation by French physicians in the October 1989 issue (see *MWN*, N/D89). Dr. James Jauchem of the Air Force School of Aerospace Medicine (see p.7) argues that MW effects in other research cited by the authors could have been thermally induced. He concludes that "inadequately reported single incidents of supposed links between microwaves and cancer serve to confuse rather than enlighten researchers and the lay public." In response, Dr. Eric Archimbaud of the Hôpital Edouard Herriot in Lyon, the lead author of the case report, cites more recent studies of MW-induced genetic damage and points out that currently recognized risk factors for this type of leukemia were first suspected in isolated cases before being confirmed by formal studies. The journal also includes a letter from Drs. B. Hocking of Telecom Australia in Melbourne and M. Garson of St. Vincents Hospital in Fitzroy, Victoria, criticizing the findings of Archimbaud and his colleagues. See "Leukaemia Following Exposure to Microwaves: Analysis of a Case Report," *British Journal of Haematology, 76*, pp.312-314, 1990.

## MEETINGS

**EPRI on Epidemiology & Dosimetry...**EPRI will sponsor two EMF workshops in early 1991, one on epidemiological studies and the other on exposure assessment. The epidemiology session will be held February 5-8 in Carmel, CA, and will be chaired by Dr. Patricia Buffler. The purpose of the workshop is "to plan the third generation studies," according to EPRI's Dr. Leonard Sagan. Dr. John Peters told *Microwave News* that he hopes to present the results of his EMF–childhood leukemia study at the workshop (see *MWN*, N/D89 and S/O90 and p.3). The second workshop, which will also be in Carmel, will address the understanding of dose at the cellular and subcellular levels. The organizers of the meeting, to be held March 19-22, are Drs. Richard Phillips (chairman), Charles Rafferty, Thomas Tenforde and Howard Wachtel.

## MILITARY

**NRC's GWEN Committee...**The National Research Council (NRC), an arm of the National Academy of Sciences, has assembled a panel of experts to assess the potential health effects of VLF radiation from the USAF Ground Wave Emergency Network (GWEN). The NRC's move was prompted by a request from the USAF, which was acting on concerns raised by Congressmen Lewis Payne (D-VA) and Les Aspin (D-WI) (see *MWN*, M/J90). Dr. Thomas Tenforde of Battelle Pacific Northwest Labs, Richland, WA, is the chairman of the panel. The other members are: Dr. Keith Florig of the Arms Control & Disarmament Agency, Washington, DC; Dr. Om Gandhi of the University of Utah, Salt Lake City; Dr. Michael Ginevan of Versar, Inc., Springfield, VA; Dr. George Harrison of the University of Maryland Medical School, Baltimore; Dr. Maureen Henderson of the Fred Hutchinson Cancer Research Center, Seattle, WA; Dr. Ross MacDonald of the University of North Carolina, Chapel Hill; Dr. Regina Santella of Columbia University, New York, NY; Dr. Thomas Slaga of the University of Texas System Cancer Center, Smithville; Dr. Jan Stolwijk of the John Pierce Foundation, New Haven, CT; and Dr. Howard

Wachtel of the University of Colorado, Boulder (currently a visiting scientist at EPRI). Dr. Raymond Cooper, the study director at the NRC, told *Microwave News* that the panel held its first meeting on December 14, 1990 and that its report should be completed by September 30, 1991.

**USAF OKs PAVE PAWS Modification...**The USAF says that it has solved its problem with the PAVE PAWS radar at Robins Air Force Base in Georgia. In 1988, the USAF admitted that radiation from the phased array radar could accidentally ignite electro-explosive devices (EEDs) aboard aircraft landing at the base (see *MWN*, J/A88, N/D88, J/F89 and N/D89). Raytheon, which built the PAVE PAWS radars, has been awarded an $8.6 million contract to install an auxiliary tracker, which will automatically shut off the radar when aircraft pass within a prescribed distance. An environmental assessment has been completed and concludes that the modification will have no significant impact.

## OVENS

**Popcorn Hazards and More...**Drs. Patrick DeRespinis and Larry Frohman, of the University of Medicine and Dentistry of New Jersey, report in the *New England Journal of Medicine* (*323*, p.1212, October 25, 1990) that the overeager consumer of microwave popcorn risks searing his or her eyes, face and hands from a hot burst of steam which can escape from the popcorn bag if it is opened immediately after cooking. DeRespinis and Frohman describe three such cases, two of which were serious enough to require treatment. All of the victims eventually recovered completely. This is not the first report of such injuries—a 1986 letter in the *New England Journal of Medicine* reported that a 10-year-old boy severely burned his eyelids when opening a bag of microwave popcorn (see *MWN*, J/F87)....The November 1990 issue of *Consumer Reports* features a section on microwave ovens, including "Microwave Worries," which explains how to avoid some common operational problems.

## PATENTS

**EMFs To Regulate Growth...**Two patents have been granted to a group of scientists for devices that use magnetic fields to control cellular processes and regulate tissue growth. The first patent (No.4818697, granted April 4, 1989) describes a method for generating a local magnetic field of a particular magnitude and direction to enhance the permeability of ions through membranes. The second patent (No.4932951, granted June 12, 1990) describes a way to use magnetic fields to regulate tissue growth. Both patents were assigned to Life Resonances, Inc., in Bozeman, MT. In the second patent, Drs. Abe Liboff of Oakland University in Rochester, MI, Bruce McLeod of Montana State University in Bozeman and Stephen Smith of the University of Kentucky in Lexington cite particular frequencies and average flux densities as most effective—16 Hz at $2.09 \times 10^{-5}$ T for stimulating bone growth and 16 Hz at $4.09 \times 10^{-5}$ T for retarding bone growth. In the second patent, they write that, "While the exact mechanism by which growth characteristics of the target tissue are affected by the present invention is not fully understood...remarkable results are achieved."

**The Cookie Monster...**Microwave cooking could become a spectator sport with the advent of the "exploding cookie." Donald Boehm and Richard Fazzolare's patented design (No.4948602, granted August 14, 1990) describes a biscuit with a hollow inside filled with chocolate. When cooked in a microwave oven, the filling boils over the top and flows down the sides of the cookie, giving "the appearance of a volcano erupting." If all that excitement leaves you in need of a comforting cup of coffee, you might try a recently patented "tea bag" (No.4948601, also granted August 14) for brewing coffee one cup at a time. According to the inventor, retired NASA astrophysicist Gideon Serbu, the microwave radiation heats the coffee grains faster than the water surrounding them, creating the natural turbulence necessary to brew coffee. A detachable frame holds the bag below water level to keep it from floating to the top of the cup and losing its flavor to the air. Copies of the patents can be obtained for $1.50 each from: Patent and Trademark Office, Washington, DC 20231.

## PEOPLE

Dr. **Samuel Milham Jr.** of the Washington state Department of Health is the recipient of the Robert Strom Foundation's first annual Humanitarian Award for making the greatest contribution to the public's understanding of EMF bioeffects. **Robert Strom**, a Boeing EMP technician who developed leukemia, launched the foundation with funds he received in a settlement with Boeing (see *MWN*, S/O90)....Dr. **Jocelyne Leal** of the Ramón y Cajal Hospital in Madrid, Spain, the president of the European Bioelectromagnetics Association, who had an accident in Madrid last June, is now back working in her lab....For their five-part series in the April 9–13 *Potomac News* on the Army's EMP testing at Woodbridge, VA (see *MWN*, M/J90), **Gary Craig** and **Kevin Carmody** have won the Southern Journalism Award for environmental reporting among newspapers with a circulation of 30,000 or less. Craig is now at the *Times Union* in Rochester, NY, and Carmody is at the *Daily Progress* in Charlottesville, VA....The newest senator from Minnesota is **Paul Wellstone**, coauthor (with Barry Casper) of the 1981 book, ***Powerline: The First Battle of America's Energy War***, an account of a heated siting conflict in rural Minnesota in the 1970s....Dr. **Joseph Bowman**, who worked on EMF epidemiological studies at the University of Southern California, will leave in January for NIOSH in Cincinnati, OH, where he will continue to study occupational exposures to ELF EMFs....Dr. **Ernest Albert** of George Washington University Medical Center died in late August due to complications following a liver transplant. A past president of the Bioelectromagnetics Society, Albert was also a member of the Scientific Advisory Panel of the New York State Power Lines Project.

## RESOURCES

**More from Paul Brodeur...**The November 19 issue of *The New Yorker* features an update by Brodeur to his July 9 piece on the Guilford, CT, cancer cluster. The piece, titled "Department of Amplification," is also a response to criticism from the Connecticut Department of Health Services (CDHS), among others. Brodeur cites as further evidence of a cluster a CDHS map—originally displayed at an August public meeting (see *MWN*, S/O90)—of the locations of the homes of 29 Guilford residents who had brain and/or central nervous system tumors between 1968 and 1988. He points out that 17 of these 29 cases were among people living near high-voltage or high-current lines. At the end of November, the CDHS announced that it would ask the Connecticut Academy of Science and Engineering to investigate the pattern of brain tumor cases in Guilford.

## VDTs

***Macworld* Goes to Washington...***Macworld* has forcefully renewed its demand for more government ELF EMF research and regulation. Editor Jerry Borrell kicked off the campaign with a special report in the July issue—"Could Your Computer Be Killing You?"—which included EMF measurements of Macintosh-compatible monitors and an article by Paul Brodeur. The latest salvo, in the December issue, includes two new articles, one by Borrell and the other by "Conspicuous Consumer" columnist Deborah Branscum. In addition, all 500,000 copies include two fluorescent orange write-in cards. Some readers will receive cards addressed to Senator Barbara Mikulski (D-MD), chairwoman of the appropriations committee that oversees the Environmental Protection Agency, and to Senator Albert Gore (D-TN). Others will get cards addressed to Dr. Allan Bromley, science advisor to the President (see p.1), and to Rep. Robert Roe (D-NJ), chairman of the House Committee on Science, Space and Technology. Each of the cards reads, in part: "I am writing to express my concern about the federal government's lack of activity on the issue of ELF (extremely low frequency) emissions from personal computer monitors. I urge you in the strongest possible terms to direct the appropriate groups...to develop an interim standard that will limit the exposure of users of personal computers to ELF emissions."

## Hand-Held Radio Risk *(continued from p.1)*

by many cellular phones (though at power levels less than 7 W), the specific absorption rate (SAR) would be 14–17 W/Kg in eye lens tissue and 19–21 W/Kg in brain tissue. At 1.5 GHz, the SARs would be 32 W/Kg and 29 W/Kg for eye lens tissue and brain tissue, respectively.

Kuster and Balzano's model points to an inconsistency in the 1982 American National Standards Institute (ANSI) limits for human exposures to radiofrequency and microwave (RF/MW) radiation, which specify both a maximum partial body exposure of 8 W/Kg, and an exemption for devices with an input power of 7 W or less operating at 300 kHz–1 GHz.

Whether to retain the 7 W exclusion clause is one of the most contentious issues in the ongoing revision of the ANSI limits. In 1989, it was deleted by the subcommittee charged with rewriting the standard at a meeting held in Tucson, AZ (see *MWN*, S/O89). Balzano, a member of the subcommittee, argued against retaining the exclusion and voted for its deletion—even though Motorola is the leading manufacturer of land mobile equipment in the world, including hand-held two-way radios and cellular telephones.

The exclusion clause was reinstated at a poorly attended meeting held in Seattle, WA, later last year in what one subcommittee member called "a peculiar process"—indeed, many subcommittee members could not say how and why it had been revived. The "final draft" of the proposed revision, as circulated last June, specifies both the partial body limit* of 8 W/Kg and the 7 W exemption, which was even extended to encompass the frequency range 100 kHz–1.5 GHz.

"I strongly oppose the exclusion clause because it could authorize devices which can induce SARs of 100 W/Kg or greater in the eye tissue," Kuster told *Microwave News*. "The electromagnetic fields from hand-held radios and cellular phones are the strongest high frequency fields to which the public is exposed, so it is ridiculous, if not negligent, to allow exclusion clauses for these devices based on a limited number of experiments," he said.

Balzano and Kuster expressed surprise that there was so little interest in their results at the BEMS meeting—while the ANSI limits were still under debate.

Last year, Drs. Robert Cleveland of the Federal Communications Commission and Whit Athey of the Food and Drug Administration reported that experiments with models of the human head indicated that ANSI's 8 W/Kg limit could theoretically be exceeded with 800 MHz hand-held radios operating at power levels as low as 3–4 W (see *MWN*, S/O89 and *Bioelectromagnetics, 10*, pp.173-186, 1989). They concluded, however, that users of such communication devices would ordinarily not transmit for periods long enough to cause the six-minute time-averaged exclusion limit to be exceeded.

Hand-held radios (transceivers) operate at various frequencies, including 150 MHz, 450 MHz and 800-900 MHz, with power levels normally ranging from about 1–2 W. Some units use higher powers, including many military units. Most hand-held cellular telephones operate at power levels of 0.6 W, while those which have their antennas mounted apart from the mouthpieces typically operate at power levels of 3 W. Cellular telephones operate at 800-900 MHz.

*Under the proposed revision, the 8 W/Kg limit applies to critical tissues like the eye and the brain and to "controlled environments." In "uncontrolled environments," the limit is 1.6 W/Kg. In each case, the dose is averaged over 10 grams of tissue. It is not clear whether the use of a hand-held communication device constitutes a controlled or an uncontrolled environment. A number of subcommittee members contacted by *Microwave News* said that they are not sure.

# NEW PUBLICATIONS

## Books

M.J. Allen, S.F. Cleary and F.M. Hawkridge, ***Charge and Field Effects in Biosystems—2,*** New York, NY: Plenum Press, 1989, 389 pp., $89.50. This collection of papers from a June 1989 symposium includes several on EMF bioeffects, with notable contributions from Soviet, Chinese and Japanese researchers (see *MWN*, S/O89).

Roger Coghill, ***Electropollution: How To Protect Yourself from It,*** Wellingborough, U.K.: Thorsons Publishing Group, 1990, 192 pp., $9.95. A review of the nature of EMFs and their health effects by a British consultant based in Wales, with suggestions for reducing exposures.

S.B. Field and J.W. Hand, editors, ***An Introduction to the Practical Aspects of Clinical Hyperthermia,*** London, U.K.: Taylor & Francis, 1990, 572 pp., $143.00. A comprehensive treatment of the clinical applications of hyperthermia, with a chapter on safety considerations for patients and operating personnel by Dr. C.K. Chou.

Giorgio Franceschetti, Om P. Gandhi and Martino Grandolfo, editors, ***Electromagnetic Biointeraction: Mechanisms, Safety Standards, Protection Guides,*** New York, NY: Plenum Press, 1989, 223 pp., $49.50. Among these lectures from a May 1988 meeting on *Worldwide Non-Ionizing Radiation Safety Standards: Their Rationales and Problems* in Capri, Italy, are a comparison of international RF/MW safety standards by Drs. Grandolfo and Kjell Hansson Mild and an overview of RF bioeffects by Dr. Stephen Cleary.

A.J. Baden Fuller, ***Microwaves: An Introduction to Microwave Theory and Techniques,*** 3rd edition, Oxford, U.K.: Pergamon Press, 1990, 310 pp., $56.00 (hardcover), $28.00 (paperback). Devoted primarily to microwave theory, circuits and waveguides. The author recommends that exposure limits for the general population be lower than 200 $\mu W/cm^2$, the level adopted by IRPA, NCRP and several states.

Om P. Gandhi, editor, ***Biological Effects and Medical Applications of Electromagnetic Energy,*** Englewood Cliffs, NJ: Prentice Hall, 1990, 573 pp., $75.00. A collection of reviews of EMF bioeffects, touching on everything from nomenclature to guidelines and standards.

John W. Gofman, ***Radiation-Induced Cancer from Low-Dose Exposure: An Independent Analysis,*** San Francisco, CA: Committee for Nuclear Responsibility, Inc., 1990, 455 pp., $29.95. A critique of the motives and methods of the "radiation community" by a well-known radiation expert who is a professor emeritus of medical physics at the University of California, Berkeley. He argues that small doses of ionizing radiation over a long period of time are no less dangerous than acute exposures, and that estimates of cancer risk from low-level exposures are inadequate for public safety.

Sanford Lakoff and Herbert F. York, ***A Shield in Space? Technology, Politics and the Strategic Defense Initiative,*** Berkeley, CA: University of California Press, 1989, 409 pp., $35.00. The authors argue that the decision to pursue "Star Wars" was motivated by politics, not science.

Y.T. Lo and S.W. Lee, ***Antenna Handbook: Theory, Applications and Design,*** New York, NY: Van Nostrand Reinhold, 1988, >1,800 pp., $149.95. A textbook on antennas, including chapters on medical applications, interference, EMP and measurements.

M.E. O'Connor, R.H.C. Bentall and J.C. Monahan, editors, ***Emerging Electromagnetic Medicine,*** New York, NY: Springer-Verlag, 1990, 307 pp., $45.00. Seventeen well-illustrated papers from a May 1989 FDA conference at the University of Tulsa, OK (see *MWN*, M/J89), on EMF theory and mechanisms, cellular and animal studies and clinical applications.

Fritz-Albert Popp et al., editors, ***Electromagnetic Bio-Information,*** 2nd edition, Baltimore, MD: Urban & Schwarzenberg, 1989, 259 pp., $72.50. An in-depth examination of some of the possible mechanisms by which organisms might use and be affected by EMFs. Ten years after the first edition and with interest growing rapidly, the foreword concludes that this once controversial discipline is now "on the right track."

Banmali Rawat and Zhou Siyong, editors, ***Proceedings of the 2nd International Symposium on Recent Advances in Microwave Technology,*** Oxford, U.K.: Pergamon Press, 1990, 660 pp., $184.00. A collection of papers on microwave measurements, measuring systems and medical applications from a 1989 meeting in Beijing, China.

Merrill Skolnik, editor, ***Radar Handbook,*** 2nd edition, New York, NY: McGraw-Hill Publishing Co., 1990, 1,199 pp., $87.50. A reference book on radar technology, including phased array and over-the-horizon systems.

U.S. Congress, Office of Technology Assessment, ***Neurotoxicity: Identifying and Controlling Poisons of the Nervous System,*** OTA-BA-436, Washington, DC: U.S. Government Printing Office, 1990, 361 pp., $15.00. A review of research on, and regulation of, neurotoxic chemicals.

Tim Weiner, ***Blank Check: The Pentagon's Black Budget,*** New York, NY: Warner Books, 1990, 272 pp., $21.95. On billion-dollar defense projects that are kept secret from the public.

Patricia M. Whitaker-Azmitia and Stephen J. Peroutka, editors, ***The Neuropharmacology of Serotonin, Annals of the New York Academy of Sciences, 600,*** 718 pp., 1990. A collection of papers on the role of serotonin in physical and behavioral functions and dysfunctions, including depression, anxiety and suicide (see also *MWN*, M/J88).

## Reports

American Statistical Association (ASA), ***ASA Conference on Radiation and Health VIII: Health Effects of Electric and Magnetic Fields: Statistical Support for Research Strategies,*** Final Report, May 1990. Copies are available for $15.00 from: Lee Decker, ASA, 1429 Duke St., Alexandria, VA 22314, (703) 684-1221. A broad overview of the research to date on the health effects of EMFs. Drs. Dan Bracken, Granger Morgan, Lee Rosen, Mays Swicord and Gilles Theriault, among others, discuss epidemiological, experimental and animal research, and outline the problems to be considered when designing future research projects. The role of statistics in facilitating measurement, analysis and risk assessment is emphasized.

David Charron, ***Magnetic Fields in the Workplace*** (P90-5E), Canadian Centre for Occupational Health and Safety (CCOHS), March 1990; ***Radiofrequency Radiation in the Workplace*** (P89-24E), CCOHS, November 1989. Copies are available free in Canada, for $3.50 in the U.S. and for $4.00 elsewhere from: CCOHS, 250 Main St. East, Hamilton, Ontario L8N 1H6, Canada, (416) 572-2981. These two reports on non-ionizing radiation health risks to workers include summaries of the exposure limits in Canada and elsewhere and recommendations on how to avoid unnecessary exposure.

Lynne De Merritt, ***Siting of Power Lines and Communication Tow-***

***ers: A Bibliography on the Potential Health Effects of Electric and Magnetic Fields*** (CPL Bibliography 257), Council of Planning Librarians, March 1990. Copies are available for $16.00 plus shipping from: American Planning Association, 1313 E. 60th St., Chicago, IL 60637, (312) 955-9100. A compilation of references—targeted to planning professionals—that provides sources of information to assist those addressing community concerns on the location of communication towers and power lines. Includes references to both the scientific and the nonscientific literature.

IIT Research Institute, ***Compilation of 1989 Annual Reports of the Navy ELF Communications System Ecological Monitoring Program*** (Technical Report E06620-4), three volumes, August 1990. Order from: National Technical Information Service (NTIS), U.S. Department of Commerce, 5285 Port Royal Rd., Springfield, VA 22161. The most recent findings from the ongoing program to determine if the U.S. Navy's ELF submarine communications system is affecting the ecology of Wisconsin and Michigan. Data collection for the study of the Wisconsin transmitting facility was completed in 1989; this report includes the results and conclusions of the bird community research. Summary reports for the rest of the Wisconsin studies were published separately and are also available from NTIS. A final report based on the data collected over the entire term of the project should be available by the end of this year.

Paul Landsbergis and Eric Scherzer, ***A Worker's Guide to Electromagnetic Radiation,*** Oil, Chemical and Atomic Workers (OCAW) Union 8 Resource Center, 1990. Copies are available for $5.00 from: OCAW District 8 Resource Center, 1155 W. Chestnut St., Union, NJ 07083, (201) 687-1322. A booklet to provide workers with a basic understanding of what is currently known about the hazards of EMF exposure. It covers the controversies surrounding research and regulations relating to health effects, including a useful discussion of the problems inherent in epidemiological research, and concludes with a section on how local unions can begin to confront the problem.

Alvin Leonard et al., ***Electric and Magnetic Fields: Measurements and Possible Effects on Human Health, from Appliances, Power Lines and Other Common Sources,*** Special Epidemiological Studies Program (SESP), California Department of Health Services (CDHS), 1990. Order from: SESP-CDHS, 2151 Berkeley Way, Room 704, Berkeley, CA 94704, (415) 540-2669. Subtitled "What we know, what we don't know in 1990," this report concentrates on EMFs in the home. It includes a number of tables and charts as well as a section on a suggested protocol for measuring residential EMFs. The authors conclude that a strategy of prudent avoidance should be adopted by concerned home owners.

Rolf Lindgren, ***High Voltage Power Lines, Health and Environment, Current Knowledge and Research Status 1989,*** Vattenfall Kraftledningar AB, first published in 1986, revised 1990. Single copies of the report are available free from: Rolf Lindgren, Vattenfall Kraftledningar AB, Nya Tingstadsgatan 1, S-422 44 Hisings Backa, Sweden, (41+31) 51.37.60. Published by the Swedish State Power Board (Vattenfall), this is a layman's guide to understanding EMF issues. The well-illustrated glossy report provides a thorough explanation of what EMFs are and where they come from and addresses the question of whether EMFs pose a threat to human health.

Oregon Department of Energy, ***Report on Human Health Effects from Exposure to 60 Hz [EMFs] from High Voltage Power Lines,*** April 1990. A limited number of copies are available free from: Dr. Tom Meehan, Oregon Department of Energy, 625 Marion St. NE, Salem, OR 97310. This report, which was prepared by a panel of five experts, was presented to the Energy Facility Siting Council, an independent state agency with the authority to set standards (see *MWN*, M/A89 and p.4). Several panel members felt that there is now "credible evidence which suggests that low levels of ELF EMFs may cause health risks to people"; the evidence is "weak, incomplete, often inconsistent and inconclusive. But it cannot be ignored." The panel members concluded that "not enough is known to set definitive or permanent standards now." They recommended limiting power line EMF exposures to status quo levels. Members of the panel included Drs. Clarissa Beatty (retired) and William Morton, Oregon Health Sciences University; Dr. Bill Guy, University of Washington School of Medicine; and Drs. Jose Reyes and René Spée, Oregon State University.

U.S. Congress, ***Electric Power Lines: Health and Public Policy Implications*** (No.101-13), Oversight Hearing Before the Subcommittee on General Oversight and Investigations of the Committee on Interior and Insular Affairs, U.S. House of Representatives, 101st Congress, Second Session, March 8, 1990. A limited number of copies are available from the subcommittee, Washington, DC 20515. The transcript of the March 8 congressional hearing called by Rep. Peter Kostmayer (D-PA), the chairman of the subcommittee (see *MWN*, M/A90). It includes the prepared testimony of research experts, industry representatives, government officials and individual citizens, their responses to questions and some written statements and letters to the subcommittee which were submitted after the hearing took place.

U.S. Congress, ***Federal Research on Electromagnetic Radiation*** (No.136), Hearing Before the Subcommittee on Natural Resources, Agriculture Research and Environment of the Committee on Science, Space and Technology, U.S. House of Representatives, 101st Congress, Second Session, July 25, 1990. A limited number of copies are available from the subcommittee, Washington, DC 20515. The expert testimony of scientific researchers, industry representatives and regulatory officials present at this July hearing, called by subcommittee chairman Rep. James Scheuer (D-NY). Included is a draft of the bill, H.R. 4801, introduced by Rep. Frank Pallone (D-NJ), which would have required the Department of Energy to investigate ways of reducing EMF exposure at home and in the workplace and to establish a comprehensive public information program on issues related to EMFs (see *MWN*, J/A90). No action was taken on the bill before Congress adjourned.

Khizar Wasti, ***Monitoring of Ongoing Research on the Health Effects of High Voltage Transmission Lines,*** Bureau of Toxic Substances Information, Virginia Department of Health (DOH) and State Corporation Commission, March 15, 1990. Order from: Virginia DOH, James Madison Building, 109 Governor St., Room 918-922, Richmond, VA 23219, (804) 786-1763. "[I]t has not been established that [EMFs] can cause an increased incidence of leukemia in humans," concluded Dr. Khizar Wasti in the Virginia DOH's fifth annual report on EMF bioeffects research (see *MWN*, M/A89). The 29-page report is a survey of bioeffects literature published in 1988-89, including reports from the Office of Technology Assessment, the California Public Utilities Commission and the IEEE Task Force (on power frequency EMFs), as well as IRPA's interim guidelines for 50/60 Hz EMFs.

***New Reports from EPRI will be featured in our next issue.***

# CONFERENCES

## 1991 Conference Calendar

January 15-19: **Coherent and Emergent Phenomena in Biomolecular Systems,** NATO Advanced Research Workshop, University of Arizona, Tucson, AZ. Contact: Stuart Hameroff, Advanced Biotechnology Lab, University of Arizona, Tucson, AZ 85724, (602) 626-6295.

January 16-18: **Hazardous Radiofrequency Electromagnetic Radiation: Evaluation, Control, Effects and Standards,** Washington, DC. Contact: Shirley Forlenzo, Continuing Engineering Education Program, George Washington University, 801 22nd St., NW, #T308, Washington, DC 20052, (202) 994-8530, or (800) 424-9773.

January 17-18: **Exploring the EMF Dilemma: Prudent Avoidance & Public Involvement,** San Francisco Airport Marriott, Burlingame, CA. Contact: NewsData Corp., Box C900928, Queen Anne Station, Seattle, WA 98109, (206) 285-4848.

January 30-31: **Scientific Workshop on the Health Effects of Electromagnetic Radiation on Workers,** Cincinnati, OH. Contact: Phil Bierbaum (R-2), National Institute for Occupational Safety and Health, 4676 Columbia Parkway, Cincinnati, OH 45226, (513) 841-4321.

February 3-7: **IEEE Power Engineering Society (PES) Winter Meeting,** Penta Hotel, New York, NY. Contact: IEEE Society Special Services, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855, (201) 562-3882.

February 4-8: **Health Physics of Non-Ionizing Radiation,** Battelle Conference Center, Seattle, WA. Contact: Dr. John Leonowich, Mail Stop K3-70, Battelle Pacific Northwest Labs, PO Box 999, Richland, WA 99352, (509) 375-6849.

February 11: **Workshop on Recent Developments in the Health Consequences and Clinical Applications of Low Frequency Electromagnetic Fields,** NIEHS, Research Triangle Park, NC. Contact: Dr. Lee Rosen, NIH, 5333 Westbard Ave., Room 2A11B, Bethesda, MD 20892, (301) 496-7568.

February 25-26: **The Debate: Electric & Magnetic Fields—An Issue for the 1990s,** Arlington, VA. Contact: Transmission & Distribution Magazine, EMF Conference, 5072 West Chester Pike, Box 556, Edgemont, PA 19028, (215) 359-1249.

February 28-March 3: **9th Annual International Symposium on Man and His Environment in Health and Disease,** ***Special Focus on EMF Health Effects,*** Dallas, TX. Contact: American Environmental Health Foundation, 8345 Walnut Hill Lane, Suite 205, Dallas, TX 75231, (214) 361-9515.

March 12-13: **IEEE 1991 National Radar Conference,** Airport Marriott, Los Angeles, CA. Contact: Radar Conference, PO Box 1827, Venice, CA 90294, (213) 647-9346.

March 12-14: **9th International Symposium and Technical Exhibition on Electromagnetic Compatibility,** Zürich, Switzerland. Contact: Prof. P.E. Leuthold, ETH Zentrum-IKT, 8092 Zürich, Switzerland, (41+1) 256-2790.

April 3-4: **27th Annual Meeting of the National Council on Radiation Protection and Measurements (NCRP),** Mayflower Hotel, Washington, DC. Contact: NCRP, 7910 Woodmont Ave., Suite 800, Bethesda, MD 20814, (301) 657-2652.

April 4-5: **17th Annual Northeast Bioengineering Conference,** Hartford, CT. Contact: Dr. Martin D. Fox, Electrical and Systems Engineering, University of Connecticut, 260 Glenbrook Rd., U-157, Storrs, CT 06269.

April 11-16: **3rd Annual Meeting of the International Society of Environmental Epidemiology,** Jerusalem, Israel. Contact: Nez Tamara Deutsch, Conference Secretariat, PO Box 61282, Jerusalem, Israel, (972+2) 243577.

April 15-18: **7th International Conference on Antennas and Propagation,** University of York, U.K. Contact: Conference Services, Institution of Electrical Engineers (IEE), Savoy Pl., London WC2R 0BL, U.K., (44+71) 240-1871, ext. 222.

April 15-18: **69th Annual Convention of the National Association of Broadcasters (NAB),** Convention Center, Las Vegas, NV. Contact: NAB Services, 1771 N St., NW, Washington, DC 20036, (800) 342-2460.

April 16-19: **International Conference on Lightning and Static Electricity,** Cocoa Beach, FL. Contact: William Jafferis, Conference Chairman, DL-ESS-22, NASA, Kennedy Space Center, FL 32899, (407) 867-4438.

April 21-25: **Symposia on Cancer, Electromagnetic Fields and Biological Systems,** as part of the **75th Annual Meeting of the Federation of American Societies for Experimental Biology (FASEB),** World Congress Center, Atlanta, GA. Contact: Patricia Burnett, Dept. of Orthopedic Surgery, LSU Medical Center, PO Box 33932, Shreveport, LA 71130, (318) 674-6179.

April 22-24: **7th Annual Meeting of the Electromagnetic Energy Policy Alliance (EEPA),** Radisson Mark Plaza Hotel, Alexandria, VA. Contact: Richard Ekfelt, EEPA, 1255 23rd St., NW, Washington, DC 20037, (202) 452-1070.

April 22-26: **11th International Conference on Electricity Distribution,** Palais des Congrès, Liège, Belgium. Contact: Secretariat, A.I.M., Rue Saint Gilles, 31, B-4000 Liège, Belgium, (32+41) 222946.

April 28-May 2: **Symposium on Microwaves: Theory and Application in Materials Processing,** Cincinnati, OH. Contact: D.E. Clark, Dept. of Mathematical Science and Engineering, 136 MAE, University of Florida, Gainesville, FL 32611, (904) 392-7660.

May 11-15: **26th Annual Meeting & Exposition of the Association for the Advancement of Medical Instrumentation (AAMI),** Washington, DC. Contact: AAMI Education Dept., 3330 Washington Blvd., Suite 400, Arlington, VA 22201, (703) 525-4890.

May 14-16: **Instrumentation/Measurement Technology Conference (IMTC/91),** Omni Hotel, Atlanta, GA. Contact: Robert Myers, IMTC/91 Conference Coordinator, 3685 Motor Ave., Suite 240, Los Angeles, CA 90034, (213) 287-1463.

May 15-17: **Biological Effects and Safety Aspects of Nuclear Magnetic Resonance Imaging and Spectroscopy,** Hyatt Regency, Bethesda, MD. Contact: New York Academy of Sciences, 2 E. 63rd St., New York, NY 10021, (212) 838-0230.

May 29-31: **45th Annual Frequency Control Symposium,** Airport Marriott, Los Angeles, CA. Contact: Clark Wardrip, PO Box 6147, Vandenberg AFB, CA 93437, (805) 865-3214.

June 11-14: **IEEE MTT-S International Microwave Symposium,** Boston, MA. Contact: MTT-Symposium 1991, c/o LRW Associates, 1218 Balfour Dr., Arnold, MD 21012.

June 13-14: **3rd Annual Meeting of the Society for Light Treatment and Biological Rhythms (SLTBR),** Toronto, Ontario, Canada. Contact: Marty McCullough, SLTBR, PO Box 478, Wilsonville, OR 97070, (503) 694-2404.

June 18-21: **5th Joint Magnetism and Magnetic Materials–Intermag Conference,** Pittsburgh, PA. Contact: Diane Suiters, Conference Coordinator, 655 15th St., NW, Suite 300, Washington, DC 20005, (202) 639-5088.

June 23-27: **13th Annual Meeting of the Bioelectromagnetics Society (BEMS),** Little America Hotel, Salt Lake City, UT. Contact: BEMS, 120 W. Church St., Frederick, MD 21701, (301) 663-4252.

June 24-28: **1991 North American Radio Science Meeting and International IEEE/AP-S Symposium,** University of Western Ontario, London, Ontario, Canada. Contact: D. Ruest, Conference Services, National Research Council Canada, Ottawa, Ontario K1A 0R6, Canada.

July 7-12: **9th International Congress of Radiation Research (ICRR),** Sheraton Centre, Toronto, Ontario, Canada. (Includes meetings of the North American Hyperthermia Group and the Radiation Research Society.) Contact: 9th ICRR, 1891 Preston White Dr., Reston, VA 22091, (703) 648-3780.

July 15-19: **28th Annual International Nuclear and Space Radiation Effects Conference,** Town and Country Hotel, San Diego, CA. Contact: Charles Barnes, Jet Propulsion Lab, MS 303-220, 4800 Oak Grove Dr.,

Pasadena, CA 91109, (818) 354-4467.

July 21-26: **36th Annual Meeting of the Health Physics Society (HPS),** Sheraton Washington Hotel, Washington, DC. Contact: HPS, 8000 Westpark Dr., Suite 400, McLean, VA 22102, (703) 790-1745.

July 21-27: **International Symposium on Charge and Field Effects in Biosystems,** Richmond, VA. Contact: Diane Holmes, Virginia Commonwealth University, Dept. of Chemistry, 1001 W. Main St., Box 2006, Richmond, VA 23284, (804) 367-1298.

July 22-25: **International Microwave Conference/Brazil,** Rio Palace Hotel, Rio de Janeiro, Brazil. Contact: Mauro Assis, Embratel-DDH, Rua da Assembléia, 10-Sala 2201, 20011-Rio de Janeiro-RJ, Brazil, (55+21) 2167108.

July 22-26: **Non-Ionizing Radiations: Health Physics and Radiation Protection,** Massachusetts Institute of Technology (MIT), Cambridge, MA. Contact: Director of Summer Sessions, Room E19-356, MIT, Cambridge, MA 02139.

July 28-August 1: **1991 IEEE Power Engineering Society (PES) Summer Meeting,** San Diego, CA. Contact: IEEE, see February 3-7 above.

August 5-7: **26th Annual Symposium of the International Microwave Power Institute (IMPI),** Hyatt Hotel, Buffalo, NY. Contact: Robert LaGasse, IMPI, 13542 Union Village Circle, Clifton, VA 22024, (703) 830-5588.

August 10-16: **Annual Meeting and Exhibition of the Society of Magnetic Resonance in Medicine (SMRM),** San Francisco Hilton and Towers, San Francisco, CA. Contact: SMRM, 1918 University Ave., Suite 3C, Berkeley, CA 94704, (415) 841-1899.

August 13-15: **IEEE 1991 International Symposium on Electromagnetic Compatibility (EMC),** Hyatt Cherry Hill, Cherry Hill, NJ. Contact: IEEE 1991 International Symposium on EMC, PO Box 609, Lincroft, NJ 07738.

September 17-20: **5th International Conference on AC and DC Power Transmission,** London, U.K. Contact: IEE, see April 15-18 above.

September 22-27: **12th IEEE/PES Transmission and Distribution Conference and Exposition,** Dallas Convention Center, Dallas, TX. Contact: Sarma Maruvada, IREQ, 1800 Montee Ste-Julie. Varennes, Quebec J3X 1S1, Canada, (514) 652-8201.

September 24-26: **13th Annual Electrical Overstress/Electrostatic Discharge Symposium,** Riviera Hotel, Las Vegas, NV. Contact: Terry Welsher, AT&T Bell Labs, 600 Mountain Ave., Rm.3B-321, Murray Hill, NJ 07974, (201) 582-5279.

September 29-October 2: **11th Annual Meeting of the Bioelectrical Repair and Growth Society (BRAGS),** Orange Tree Resort, Scottsdale, AZ. Contact: Ethel Pollack, BRAGS, PO Box 64, Dresher, PA 19025, (215) 659-5180.

September 30-October 3: **Radiation Protection for Man and Environment,** Aachen, Germany. (The meeting commemorates the 25th anniversary of the founding of the German-Swiss Society for Radiation Protection.) Contact: Dr. H. Jacobs, Forschungszentrum, Jülich GmbH, Postfach 1913, 5170 Jülich, Germany, (49+2461) 3188.

October 8-10: **International Conference on Microwaves and High Frequencies,** Nice, France. Contact: Comité Français de L'Électricité, Tour Atlantique – Cedex 06, 92080 Paris–La Défense, France, (33+1) 47.73.66.15.

October 15-18: **1991 EPRI EMF Utility Seminar,** San Jose, CA. Contact: Radiation Studies Program, Electric Power Research Institute, Palo Alto, CA, (415) 855-2320.

October 31-November 3: **13th Annual International Conference, IEEE Engineering in Medicine and Biology Society,** Orlando, FL. Contact: Dr. Joachim Nagel, Dept. of Biomedical Engineering, University of Miami, PO Box 248294, Coral Gables, FL 33124, (305) 284-2442.

December 9-12: **6th International Conference on Mobile Radio and Personal Communications,** Warwick, U.K. Contact: IEE, see April 15-18 above.

### *Dates and Locations To Be Announced*

November: **Annual Department of Energy Contractors Review.** Contact: W/L Associates, 120 W. Church St., Frederick, MD 21701, (301) 663-1915.

December: **1st Meeting of the European Bioelectromagnetics Association.** Contact: Dr. Jocelyne Leal, Departamento de Investigacion, Hospital Ramón y Cajal, Madrid 28034, Spain, (34+1) 358-1365.


## *EMF Papers*

*A clipping service on non-ionizing radiation*

*Microwave News* now offers *EMF Papers.* For only $100 per month you will receive a packet twice a month containing the most recent literature on electromagnetic fields, keeping you up-to-date on all the news in the news. It's the perfect complement to your subscription to *Microwave News.*

Subscribe today, or send $25 for a sample packet.
To order, call: (212) 517-2800.

## *Microwave News*
## *Bound Editions*

- The first five years of *Microwave News* (1981-1985) are now available as a bound volume for $450.
- A second volume (1986-1990) will be available in early 1991 for $450.
- For a limited time only, both volumes (ten years of *Microwave News*) are available for $750.

For more information, contact:
Louis Slesin at (212) 517-2800.

## Order *Microwave News*

[ ] 1-year subscription (6 bimonthly issues) for $250.00 ($285.00 Canada & Foreign).

[ ] 6-month trial (3 bimonthly issues) for $130.00 ($150.00 Canada & Foreign).

[ ] ____ back issues, 1981-1989, $95.00 per year ($100.00 Canada & Foreign).

[U.S. Funds Please]

Order from: *Microwave News,* PO Box 1799, Grand Central Station, New York, NY 10163, (212) 517-2800.

Name_____
Institution_____
Address_____
City_____
State_____ Zip _____

# CLASSIFIEDS


**ELF MAGNETIC FIELD METER**
**MFG. by COMBINOVA AB, SWEDEN**



- Meets Swedish requirements for accuracy.
- Locates sources 5 to 2000 Hz.
- Accurate, rugged, portable
- Programmable, stores 4000 measurements.

ERGONOMICS, INC.

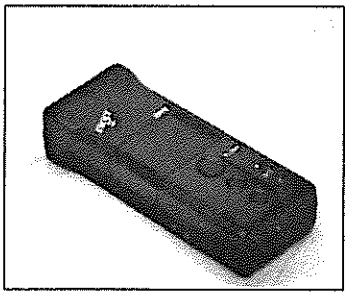
P.O. BOX 964 • SOUTHAMPTON, PA 18966 • (215) 357-5124 / FAX (215) 364-7582

**Magnetic Field Monitors**
**Management & Detection**
**of**
**Electromagnetic Fields**

For Information Write:
Terry Abblett, 2151 Granada Street, Napa, CA 94559

Safe VDTs with 0.0 milliGauss (magnetic radiation) as well as 0.0 Volts/meter (electric radiation) at 60 Hz and at VLF frequencies. Used by U.S. Congress, U.S. EPA, NY State & Yale Medical School. Magnetic radiation milliGauss meters to measure power lines, VDTs, TVs. Call George Lechter at (800) 222-3003 or (617) 444-7778, or write for literature to Safe Computing, Inc., 368 Hillside Ave., Needham, MA 02194. The Safe Monitor has been featured on CNN, NBC and CBS.

EMDEX II



The Latest in EMF Technology

- Power-Frequency Magnetic Field Meter
- Latest Version of EPRI's EMDEX Meter
- On-Board Computer with 156k Memory
- Broadband & Harmonic Measurements
- 0.0 mG to 3.00 Gauss Range
- GUI User-Friendly Software Included
- All For Only $1695

Enertech Consultants
300 Orchard City Drive, Suite 132
Campbell, California 95008
(408) 866-7267

The George Washington University
WASHINGTON DC

**HAZARDOUS RADIO FREQUENCY ELECTROMAGNETIC RADIATION**
**Evaluation, Control, Effects and Standards**

Course No. 588DC – January 16-18, 1991 in Washington, DC Fee: $940

This short course examines the risks of exposure to intense RF fields for humans, sensitive electronics equipment, ordnance devices, and fuels. It provides broad understanding of the sources of RF electromagnetic fields, their transmission and interaction mechanisms, how to detect and quantify the fields, and how to protect equipment and people from their effects. The presentation is basically descriptive, with minimal use of mathematics. Examples of actual RF field surveys, investigation of potential overexposure by humans, and typical problem-solving methods are provided.

The course should be especially valuable to members of the medical electronics profession, manufacturers of portable and hand-held radio equipment, and users of test and industrial electronics equipment in addition to managers, scientists, physicians, attorneys, engineers, industrial hygienists, environmental specialists, security and law enforcement personnel, electronic systems planners, and equipment operators in government, industry and academe who need a better working knowledge of the topic.

**Instructors:** Dr. Bernhard E. Keiser and Dr. Zory R. Glaser

For complete information, contact Shirley Forlenzo – Continuing Engineering Education Program
(202) 994-8530 or Toll Free (800) 424-9773 FAX: (202) 872-0645

GW is an equal opportunity institution

# MICRO WAVE NEWS

Vol. XI No. 6 A Report on Non-Ionizing Radiation November/December 1991


INSIDE...


## EMF NEWS pp. 2-8

**Power Line Talk:**
- Female Breast Cancer Study Expected • Russel Reiter To Get EPRI Funding • Ban on New Power Lines Proposed in Wisconsin • California PUC Update • Responses to Park Piece

**Commentary:**
- No More Literature Reviews! No More Research Agendas!

**Congressional Budget Proposals**

**EPA EMF Budget Increases**

**California Governor Vetoes $7 Million Bill**

**NERP Gains Support, Gets Start-Up Funding**

**Wertheimer: Research After Peters**

**HEI Board Delays Research Plan**

**Cancer Epi Studies: Taiwan, Sweden & U.K.**

**New Reports from EPRI**

## HIGHLIGHTS pp.8-10

**Connecticut Police Ban Hand-Held Radar**

**RF/MW Resources:**
- Abstracts of Research Reports and Papers

## FROM THE FIELD pp.10-11

**German Workshop on EMF Mechanisms**

**EMFs from Light Boxes**

**Exposures Among Aluminum Workers**

## UPDATES pp.11-12

**More on EMI and Apache Helicopters • Fire Wrecks Japanese Maglev Vehicle • OTA Report on Circadian Rhythms • Attorney's Advice to Utilities • EMI Leads to Apnea Monitor Recall • NIOSH Proceedings Out • Papers from Australian ELF Workshop • NRPB NIER Chart • Microwaves and Murder at the FCC • and more...**

## CONFERENCES pp.13-14

**1992 Conference Calendar**

## CLASSIFIEDS pp.15-16


# DOE Maps Out National EMF Research Agenda

Moving quickly to assert its new role as the lead federal agency on electromagnetic field (EMF) health research, the Department of Energy (DOE) is preparing a national agenda to coordinate federal, state and private research programs. DOE's EMF budget remains uncertain, however, despite talk of a major increase in research funding.

"It's time to mobilize and become more active," DOE's Dr. Robert San Martin announced at a DOE workshop on *Development of a Coordinated Research and Communication Program on Potential Health Effects of Electric and Magnetic Fields*, held November 20-21 in Arlington, VA. A DOE assistant secretary, Michael Davis, the highest-ranking DOE official at the workshop, agreed: "Clearly, not enough has been done to satisfy questions about adverse health effects." San Martin, who, as deputy assistant secretary for utility technologies, is responsible for the department's $5 million EMF research budget, outlined what he called an "ambitious" schedule, which would put the new agenda into place as early as next spring.

Most workshop participants were pleased by the new sense of importance given to EMF research. Many were encouraged by the fact that Secretary of Energy Admiral James Watkins had signed the invitations to the workshop himself. Indeed, the issue has caught the interest of top-level Bush Admin-

*(continued on p.14)*

# IEEE OKs New ANSI RF/MW Limits; Work Begins on ELF Standard

The Institute of Electrical and Electronics Engineers (IEEE) has approved revisions to the American National Standards Institute (ANSI) guidelines for human exposures to radiofrequency and microwave (RF/MW) radiation. On September 26, the IEEE Standards Board endorsed the guidelines drafted by its Standards Coordinating Committee (SCC) 28 for frequencies between 3 kHz and 300 GHz.

The new standard, designated C95.1–1991, replaces the one adopted by ANSI in 1982 (see *MWN*, S82). In the absence of federal rules, the limits have been the de facto U.S. exposure standard. The 1991 guidelines will likely assume equal importance.

The key differences between the old and the new standards are:

• The exposure limits for workers and the general public are no longer identical. Instead, separate guidelines are specified for "controlled" and "uncontrolled" environments. Uncontrolled areas are defined as those where individuals "have no knowledge or control of their exposure."

• The exposure limits have been doubled to 10 mW/cm$^2$ above 1.5 GHz and

*(continued on p.15)*

## « Power Line Talk »

After five years of writing proposals, Dr. **Richard Stevens** of the Battelle Pacific Northwest Labs may finally get the funds he needs to investigate the association between female **breast cancer** and exposures to light-at-night and/or EMFs. An announcement is not expected until February, but Stevens told *Microwave News* that, "Funding is very probable because the reviewers gave us a good enough score to put us in the money." Stevens will be working with Dr. **Scott Davis** of the Fred Hutchinson Cancer Research Center in Seattle, WA, who will be the principal investigator on the four-year case–control study of some 500 women with breast cancer and 500 controls. "I'm really thrilled about this," Stevens said.

«« »»

Dr. **Russel Reiter** at last appears to have secured a sponsor for his research. "We've agreed on a two-year contract," **EPRI**'s Dr. **Chuck Rafferty** told *Microwave News* at the DOE meeting in Milwaukee in early November. "Everything is settled but the signature." Reiter will continue his work on isolating the key field parameters that determine the effects of EMFs on the pineal gland. In an interview, Reiter said that he was optimistic that the grant would go through after an October 30 site visit by an EPRI team led by Dr. **Rob Kavet**, a consultant based in Belmont, CA. If all goes according to plan, EPRI will help build a "Cadillac facility" at Reiter's lab at the University of Texas Health Science Center in San Antonio. Despite his international reputation, Reiter has been unable to secure funds up to now—indeed, he had been talking of quitting EMF work if he did not win support soon. To make his point, at the bottom of his Milwaukee abstract, Reiter wrote: "Unsponsored Research."

«« »»

Add **Wisconsin** to the list of states considering a temporary **ban on new power lines** because of concerns over possible EMF health effects (see *MWN*, M/J91). On November 6, **Maxine Hough** and eight other state representatives, along with two state senators, introduced legislation calling for a three-year moratorium on new lines above 60 kV. The bill would require the **Wisconsin Public Service Commission** (PSC) to conduct EMF research and measurement surveys during the moratorium. "It is dangerous and foolhardy to build more high voltage power lines...until we have adequate answers to the health concerns," Hough said at an October 7 press conference. Last year, Wisconsin legislators and their staffs were disturbed to learn that EMFs as high as 400 mG had been recorded in the building where they work (see *MWN*, J/F91). Madison Gas & Electric reduced the levels by reconfiguring wires and by redesigning the electrical vault, but average readings of up to 125 mG remain in some areas. Hough's announcement came the same week that the PSC held technical hearings on EMFs as part of its 20-year advance planning process. Among those testifying at the hearings were: Dr. **Abe Liboff**, Dr. **Bruce McLeod**, Dr. **John Moulder**, **Greg Rauch**, Dr. **David Savitz** and **Michael Silva**. At public hearings held later in October, members of the citizens' group Promoting Options for Wise Energy Regulation (**POWER**) pressed the PSC to impose its own moratorium. The PSC's board is expected to issue a strategy for addressing EMF concerns in January. State legislators in Michigan, Rhode Island and Tennessee, as well as local officials in Missouri, Rhode Island, Tennessee and Washington State, have proposed power line bans.

«« »»

**Meg Gottstein** has replaced **Steve Weissman** as the administrative law judge presiding over the **California Public Utilities Commission** (PUC) investigation of potential health effects of EMFs. "Staffing issues and caseloads" were the reason for the switch, Gottstein told *Microwave News*. In her first ruling, issued October 11, Gottstein denied a July 15 motion from the Cellular Carriers Association of California and the **Cellular Telecommunications Industry Association** requesting exemption from the investigation. In their motion, the trade groups asserted that there was no evidence linking their transmission facilities to health risks. They supported their claim with testimony from Dr. **Bill Guy**, who recently retired from the University of Washington, Seattle, Dr. **Don Justesen** of the VA Medical Center in Kansas City, MO, and Dr. **Jerrold Bushberg** of the University of California, Davis, and by pointing to present ANSI and NCRP standards (see p.1). Gottstein wrote that, "While [the cellular industry groups] assert that their conclusions...are unequivocal, other parties to this proceeding have raised questions concerning the adequacy and safety of existing standards, and argue that additional review of scientific evidence and expanded exposure monitoring [are] warranted." At a November 8 meeting, it was decided that the PUC would conduct a "sub-investigation" into health effects from cellular facilities. The PUC began its investigation into EMF health effects in January 1991. In February 1992, the EMF "consensus group" of utility representatives, legislators and members of the public

*MICROWAVE NEWS* is published bimonthly • ISSN 0275-6595 • PO Box 1799, Grand Central Station, New York, NY 10163 • (212) 517-2800; FAX (212) 734-0316 • Editor and Publisher: Louis Slesin, PhD; Managing Editor: Robert Dieterich; Associate Editor: Barton Biggs; Assistant Editor: Andrew Goffe; Contributing Editors: Jennifer Goren, Mark A. Pinsky; Copy Editors: Jim Feldman, Peter Pullman; Circulation Director: Barbara Gerson • Subscriptions: $285.00 per year ($315.00 Canada & Foreign, U.S. funds only); single copies: $50.00 • Copyright © 1991 by Louis Slesin • Reproduction in any form is forbidden without written permission.

*Commentary*

## *No More Literature Reviews! No More Research Agendas!*

Ask people what needs to be done about the EMF problem and they will answer "more research." Sound advice, but advice only a few can follow because of the lack of available funding.

The frustrations of those seeking grants turned to outrage when, in August, Congress gave the NAS-NRC $600,000 for yet another literature review. They point out that this is more money than any federal agency except the DOE is now spending on EMF research and that this amount is enough to open a couple of labs or support a host of postdocs.

Someone forgot to tell Congress that EPA, after combing through the literature for three years, issued a landmark 460-page review; that the White House has already ordered CIRRPC to repeat the process; that NIOSH commissioned a collection of expert reviews; that at least seven states are mandating their own reviews—Connecticut's alone is costing $150,000, while Maryland and Virginia are paying for annual updates; and that EPRI and NEMA have sponsored their own assessments, as has the U.K.'s NRPB. And, of course, the various branches of the DOD had to have their own reviews.

Then there are the reviews of the reviews. The SAB spent a year going over the EPA cancer report before issuing its own analysis. CIRRPC has canvassed all branches of the federal government for their views of the EPA report and, across the Atlantic, the NRPB has asked a committee to render one more opinion.

EPA and NIOSH have spent most of their scant resources devising lists of research needs. Actually, EPA did this twice: staffers developed their own strategy and then, for good measure, paid HEI $525,000 for a second opinion. (The two sets of priorities are, not surprisingly, quite similar.) Not to be left out, the leaders of BEMS are writing their own agenda. One researcher who has worked on a number of these wish lists commented at the DOE's November workshop in Washington: "They all recommend the same thing. We know what needs to be done."

Despite all the planning, EPA and NIOSH still have not started their own research programs. Ironically, a good number of those shuttling from meeting to meeting—offering opinions on what is and what is not known about EMFs—have been denied research funds. As for those lucky enough to have grants, it is a wonder that their travel schedules leave any time for research.

In controversial areas of environmental policy, decision makers put off the hard choices by asking for more research. In the EMF business, even this tactic is seen as too risky. Instead they ask for reviews and agendas. This kind of cowardice explains why some of the most interesting work in the field has been supported out of researchers' own pockets. Dr. Nancy Wertheimer, Ed Leeper, Dr. Abe Liboff and Dr. Russel Reiter, for example, have worked without grants, yet their contributions are greater than those of many researchers with institutional support.

At the DOE research review in Milwaukee, Dr. Keith Florig of RFF estimated that the EMF problem already costs the U.S. economy $1 billion a year—an amount he believes will keep growing. Even if Dr. Robert Adair and colleagues are right that EMFs pose no health risks, they should recognize that it is too late for categorical denials. It is time they joined those who seek to settle the EMF problem with data, not dictums.

But most of all, it is time to stop stalling and get some work done.

*Abbreviations:* BEMS—Bioelectromagnetics Society; CIRRPC—Committee on Interagency Radiation Research and Policy Coordination; DOD—Department of Defense; DOE—Department of Energy; EMFs—Electromagnetic Fields; EPA—Environmental Protection Agency; EPRI—Electric Power Research Institute; HEI—Health Effects Institute; NAS-NRC—National Academy of Sciences-National Research Council; NEMA—National Electrical Manufacturers Association; NIOSH—National Institute for Occupational Safety and Health; NRPB—National Radiological Protection Board; RFF—Resources for the Future; SAB—Science Advisory Board.

will submit a report and recommendations to the PUC on power frequency fields—this will serve to "narrow the scope of the investigation," Gottstein said in a telephone interview.

«« »»

Two newspapers have now published letters in response to Dr. **Robert Park**'s recent op-ed piece bemoaning "hysterical" reactions to EMFs (see *MWN*, S/O91). A letter by attorney **Kieron Quinn**, which had not appeared before our last issue went to press, ran in the Baltimore, MD, *Evening Sun* on November 6 under the headline, "A Huckster of Junk Science." Dr. **Stephen Cleary** of Virginia Commonwealth University also wrote a letter after the Richmond, VA, *Times-Dispatch* ran Park's piece. Cleary's letter, published September 17, points to the same National Cancer Institute data showing a surge in cancer rates that **Paul Brodeur** cited in his September 6 letter to the *New York Times*. Brodeur's letter still has not appeared in print.