

FROM THE FIELD

Vernon, NJ: Cluster Continues

During the last five years, we have reported on the continuing controversy of the cluster of Down's syndrome and other genetic defects among babies born to residents of Vernon, NJ. (See MWN, November 1982, September 1984, May and November/December 1985 and July/August 1986.) In the letter reprinted below, Dr. Robert Becker, formerly a professor at the State University of New York Upstate Medical Center in Syracuse, and now a consultant, writes that the cluster continues to grow.

There appears to be a misconception as to the current status of the incidence of genetic defects in Vernon, NJ. It is frequently stated that no new cases have occurred since January 1, 1985, and, since the number of microwave sources in the town has steadily increased since the late 1970s, there can be no causal relationship between the levels of microwaves and such defects. I have assisted the citizens' group, CAT, in collecting and evaluating data since 1981, and am familiar with the current situation. In 1986, one case of Down's syndrome was born. In 1987, there were two other Down's births (one Trisomy 21, the other T 13), as well as one other child born with major defects in 3 chromosomes.

The yearly incidence of proven genetic defects in Vernon reveals a possible periodicity of occurrence. The following table lists the 17 cases (Down's-11, Edward's-2 and other chromosomal anomalies-4) by year of birth.

1975—2	1979—3	1982—1	1985—0
1976—0	1980—2	1983—1	1986—1
1977—0	1981—2	1984—1	1987—3
1978—1			

If a periodicity does exist and a peak was reached in 1980, it is possible that the cases occurring in 1986 and 1987 represent the beginning of a second peak in incidence. In any event, the data may be interpreted to indicate the following: First, an overage of genetic defects does exist in Vernon (expected number: 3.4 cases; actual number: 17—approximately a 500% excess since 1975). It should be noted that these data were gathered by voluntary reporting to the citizens' group; the actual incidence is likely higher than these figures indicate. Second, the situation in Vernon has not gone away, the genetic disease incidence is again on the rise. Third, there is not a direct linear relationship between the field strength of the microwaves and the incidence of genetic abnormalities. This suggests that the microwaves may be a cofactor and a second variable may be involved. At present I am attempting to evaluate the possible role of the geomagnetic field in this periodicity.

It is clearly evident that a health problem of considerable magnitude continues to exist in Vernon and may be related, at least in part, to the levels of microwave radiation present in the town.

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Ongoing Research on Power Line Electric and Magnetic Fields

The information below, current as of January 1, 1988, is adapted from a table assembled by Dr. Lee Rosen of W/L Associates, a consulting firm based in Frederick, MD.

Institution	Source	Exposure	Subjects	Comments
Argonne Natl. Lab.	DOE	E	Rodents	Characterization of circadian phase shifts.
Battelle Pacific NW Lab.	EPRI	E	Rodents	Immune stimulation—cellular and humoral.
	DOE	E	Rodents	Neuroendocrinology, tumor induction, behavior.
	DOE	E&M	In vitro	Characterization of membrane effects, oncogene studies, DNA sensitivity.
	EPRI	M	Humans	Use of E-blankets to test human pineal hormonal response.
Elect. Res. & Management	EPRI	M	Engineering	Addition of M-field to previously built E-field facilities for teratology.
Enertech Consultants	EPRI	M	Engineering	Exposure assessment instrumentation and software for computer modeling.
Johns Hopkins U.	EPRI	Occup.	Workers	Retrospective case control study of AT&T workers with field measurements.
Lawrence Berkeley Lab.	DOE	M	In vitro	Membrane studies, phase transitions.
McGill U.	OH & HQ*	Occup.	Workers	Use of records from Canadian and French utilities.
Midwest Res. Inst.	DOE	E&M	Humans	Acute exposure to continuous and intermittent fields.
SW Res. Inst.	DOE	E	Primates	Operant and social behavior.
Oakland U.	DOE	M	In vitro	Cyclotron resonance studies; calcium markers.
U. of North Carolina	EPRI	Occup.	Workers	Leukemia and brain cancer among electric utility workers.
U. of Rochester	DOE	E	Rodents	Operant behavior.
U. of the South	EPRI	E	Engineering	Scaling study related to cage conditions and the impact of animals on dosimetry.
U. of Southern CA	EPRI	Resid.	Children	Case control study of childhood leukemia.
	EPRI	M	Workers	Characterization of occupational exposures.
U.S. VA, Loma Linda, CA	DOE	E&M	In vitro	Characterization of cell membrane response to applied fields.
	DOE	E	Rodents	Evaluation of mechanisms of interaction to applied fields.

* Ontario Hydro and Hydro Quebec

UPDATES

BIOLOGICAL EFFECTS

Risks of Controlling Static...An anti-static agent in plastic tote boxes was responsible for an outbreak of dermatitis among employees of a microelectronics firm, according to a NIOSH study by Dr. Diane Bennett and coworkers. The anti-static agent, bis-hydroxyethyl-tallow amine (BHETA), which was detectable as an oily film on the surfaces of the boxes, caused skin rashes on the hands and arms of 14 out of 29 of those working in direct contact with it. Employees also noted corrosion of electrical equipment stored in the treated boxes. Researchers investigating the problem concluded that BHE-TA is a strong skin irritant and a potential skin sensitizer. The study appeared in the *Journal of Occupational Medicine*, 30, pp.252-255, March 1988. For more information, contact: Dr. Toby Mathias, NIOSH, R-13, 4676 Columbia Pkwy, Cincinnati, OH 45226.

COMPATIBILITY & INTERFERENCE

Thiokol Fined for ESD-Sparked MX Fire...A team of U.S. Air Force investigators has concluded that a December 29 MX missile explosion at a Morton Thiokol plant in Utah was caused by electrostatic discharge (ESD) or friction. The Utah Division of Occupational Safety and Health has fined Thiokol \$31,700 for "willful" and "serious" safety violations committed by the company and by the five workers who died in the fire. Thiokol officials say the company will appeal the fine (see *MWN*, September/October 1987 and January/February 1988).

Tips for Fixing EMI...The Electronics Industries Association (EIA) and the FCC have released a pamphlet, *Consumers Should Know Something About Interference: Tips on Searching It Out - and Some Fixes*. It explains the common types of EMI to consumer electronic products - TVs, VCRs, stereos and cordless phones - and how to resolve them. Copies are available from: Consumer Affairs, EIA, 2001 Eye St., NW, Washington, DC 20006; or from: Public Service Division, FCC, Room 725, 1919 M St., NW, Washington, DC 20554.

Post Office EMC Tests...The U.S. Postal Service (USPS) is seeking a contractor to perform EMI tests on six different types of stamp vending machines. The bidder chosen will determine whether the equipment meets military standards for conducted and radiated susceptibility in the 10 kHz to 1 GHz frequency range. Proposals for the one-year project were due April 18. For more information on solicitation No. 104230-88-B-0071, contact: C. Kennedy, USPS Headquarters, Office of Procurement, Room 1131, 475 L'Enfant Plaza West, SW, Washington, DC 20260, (202) 268-4103.

MEETINGS

BEMS Symposia...In addition to the usual complement of papers, posters and workshops, the *10th Annual Meeting of*

the Bioelectromagnetics Society (BEMS), to be held June 19-23 in Stamford, CT, will feature four symposia: (1) Microwave Hyperthermia for Cancer Treatment; (2) Use of Electric and Magnetic Fields for Tissue Healing; (3) Mechanisms of Interaction of Electric Fields with Cell Membranes; and (4) Behavioral and Physiological Effects of High Peak Power Microwave Pulses. The first two symposia have been approved for continuing medical education (CME) credit. The meeting will be held at the Westin Hotel, which is offering a \$58/night (single or double) discount rate for BEMS conferencees. To make a reservation, call: (800) 231-2042. For more information about the meeting, contact: BEMS Executive Director Dr. William Wisecup, 120 W. Church St., Frederick, MD 21701, (301) 663-4252.

VDT Measurements...The IEEE EMC Society's Working Group P1140 on *Near-Field Testing Procedures for Electric and Magnetic Fields* will meet on or around June 17 in Connecticut. The time and location will be set to coordinate with the BEMS meeting. The working group had originally planned to meet in March, but the session was canceled because Swedish researchers were unable to attend. On the agenda are reviews of spectral energy and time derivative methods, as well as a report from Finland. For more information, contact: Stephen Berger, Electro-Mechanics Co., 10620 Metric Blvd., Austin, TX 78758, (512) 835-4684. (See also *MWN*, July/August 1987.)

HPM Weapons...The *4th National Conference on High Power Microwave Technology for Defense Applications* will be held at the U.S. Naval Post Graduate School in Monterey, CA, May 9-13. The objective of the conference is "to examine the service operational mission utility and weapons potential of high power microwaves" (HPM). Among the papers scheduled are a report on susceptibility measurements on an M1 tank and studies of avionics and the effects of HPMs on an artillery fuse. There will be a session on bioeffects, chaired by Dr. John de Lorge of the Naval Aerospace Medical Research Lab in Pensacola, FL, who will also review the behavioral effects of HPMs. Representing the other services, Howard Bassen will discuss the army's program and James Merritt will go over the USAF's research. Over 600 scientists and engineers attended the third HPM meeting in December 1986 (see *MWN*, January/February 1987 and January/February 1988). Attendees must have a "secret" security clearance. For more information, contact: Kindra Landry, American Defense Preparedness Association, Rosslyn Center, 1700 North Moore St., Suite 900, Arlington, VA 22209, (703) 522-1820.

1989 Zurich EMC Symposium...A call for papers has been issued for the *8th International Symposium and Technical Exhibition on Electromagnetic Compatibility*, which will be held in Zurich, March 7-9, 1989. This biannual meeting attracts experts from all over the world: the 1987 symposium had 930 participants from 28 different countries. For more

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information, contact: Dr. T. Dvorak, ETH-Zentrum-IKT, CH-8092 Zurich, Switzerland, (1) 256-2790; or in the U.S., Dr. Ralph Showers, Dept. of Electrical Engineering, University of Pennsylvania, Philadelphia, PA 19104, (215) 898-8123.

MILITARY SYSTEMS

Ideas for Weapons...The Naval Surface Warfare Center (NSWC) and the Defense Advanced Research Projects Agency are accepting proposals "in microwave effects testing and compact source development" through June 30. Specifically, the proposed research should include experiments demonstrating "the enhanced effects of frequency modulation, multiple frequencies, waveform modulation and pulse shaping of microwaves on electronics systems." For more information, contact: Karen Jackson, Code S22, White Oak Laboratory, NSWC, 10901 New Hampshire Ave., Silver Spring, MD 20903.

OTH-B Radar Operational...The over-the-horizon backscatter (OTH-B) radar system, which can detect cruise missiles up to 2,000 miles away and "at ranges almost 10 times further than conventional ground-based radars," is now operating at limited capacity in Moscow, ME. The Electronic Systems Division of the USAF is now testing the system 12 hours/day, rather than full-time, due to software development problems. The radar, which transmits signals in the 5-28 MHz range, is expected to be fully operational next year when General Electric, the system's contractor, finishes work on the system's third sector and completes the software design. Another OTH-B is already under construction on the West Coast and the USAF has plans for one in Alaska and one in the Midwest - though these are now in doubt; in late March, a House subcommittee canceled the USAF's \$161 million request for OTH-B procurement....Meanwhile, the Navy is scheduled to move its relocatable over-the-horizon radar (ROTHR) from Virginia to Amchitka Island in the Aleutians to detect Soviet aircraft and ships. The USAF and the Navy will link their systems to "provide wide area surveillance," reports *Aviation Week* (March 21).

PEOPLE

The top EMF journals are going through changes. Dr. Don McRee of NIEHS was scheduled to become editor-in-chief of *Bioelectromagnetics* but had to decline due to time constraints. EPA's Dr. Richard Phillips will continue to run the journal, published by the Bioelectromagnetics Society, until a replacement is named. A search is also underway at *The Journal of Microwave Power and Electromagnetic Energy*, published by the International Microwave Power Institute (IMPI) - Dr. Geoffrey Voss of Voss Associates Engineering in Victoria, Canada, has resigned as the editor. And the officers of the Health Physics Society are not only looking for someone to replace Dr. Genevieve Roessler as the editor of

Health Physics, but also for a replacement for John Tolan, who is stepping down as editor of the society's *Newsletter*. At the *IEEE Transactions on EMC*, the succession is settled: Dr. Motohisa Kanda has taken over as editor from Richard Schulz, a consultant who retired from Xerox Corp. not long ago. In March, the first issue of *Microwave and Optical Technology Letters* will appear. Published ten times a year by Wiley-Interscience and edited by Professor Kai Chang of Texas A&M, the journal promises quick publication - no more than two-four months from time of submission. Another new publication is the quarterly *Journal of Electromagnetic Waves and Applications*, edited by J.A. Kong of MIT and published by VNU Science Press in The Netherlands.

A number of bioeffects and EMC researchers were recently named IEEE Fellows: Drs. Kenneth Foster of the University of Pennsylvania and Saul Rosenthal of Polytechnic University were elected for their work on bioeffects, and Ed Bronaugh of Electro-Metrics, Dr. Motohisa Kanda of NBS and Henry Ott of AT&T Bell Labs were named for their contributions to EMC studies....Stanley Salek, formerly with Circuit Research Labs in Tempe, AZ, has joined the NAB as a staff engineer....Franklin Jarman has been forced out as acting chief executive officer of Clini-Therm Corp., a manufacturer of hyperthermia treatment units. Charles Hill, a management consultant, is taking over on an interim basis.

STANDARDS

CISPR Draft Rules...CISPR subcommittees have released the following six-month draft rules: (1) *Limits and Methods of Measurement of Radio Interference Characteristics of Vehicles, Motor Boats, and Spark-Ignited Engine-Driven Devices*, CISPR/D(Central Office)17 (\$28.00); (2) Seven amendments to CISPR 14, *Limits and Methods of Measurement of Radio Interference Characteristics of Household Electrical Appliances, Portable Tools and Similar Electrical Apparatus*, CISPR/F(Central Office)44-50 (\$51.00 for the set); (3) Three amendments to CISPR 15, *Limits and Methods of Measurement of Radio Interference Characteristics of Fluorescent Lamps and Luminaires*, CISPR/F(Central Office)51-53 (\$23.00 for the set); and (4) Four amendments to CISPR 16, *CISPR Specifications for Radio Interference Measuring Apparatus and Measurement Methods*, CISPR/A(Central Office)42-45 (\$63.00 for the set). All are available (prepaid) from: ANSI, International Sales Department, 1430 Broadway, New York, NY 10018, (212) 642-4900.

Radiated and Conducted Emissions...ANSI has requested comments on drafts of a number of new and revised standards: (1) *Recommended Practice for the Measurement of RF Emissions from Industrial, Scientific and Medical Equipment Installed on User's Premises*, BSR/IEEE 139 (\$15.00); (2) A revision and redesignation of ANSI C16.25-1962, *Procedure for Measuring Conducted Emissions in the Range of 300 kHz*

to 25 MHz from FM and Television Broadcast Receivers to Power Lines (\$10.00); (3) A proposed revision of ANSI C63.4-1981, *Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronics Equipment in the Range of 10 kHz to 1 GHz*, BSR C63.4 (\$10.00); (4) *Calibration of Antennas Used for Radiated Emissions Measurements in Electromagnetic Interference (EMI) Control*, BSR C63.5 – methods for determining antenna factors for radiated emissions from 30 MHz to 1 GHz (\$10.00); (5) *Guide for the Computation of Errors in Open-Area Test Site Measurements*, BSR C63.6 – explanation of the basis of the ± 4 dB criterion for the site attenuation measurements required in C63.4 (\$6.00); and (6) *Guide for Construction of Open-Area Test Sites for Performing Radiated Emission Measurements*, BSR C63.7 – information on emissions in the range of 30-1000 MHz (\$8.00). The first two drafts are available from O. Edwards, and the others from Fred Huber, Jr., both at: IEEE, 345

East 47th St., New York, NY 10017.

ETC...

Literature Review... For its 22nd general assembly, held last summer in Tel Aviv, URSI prepared a *Review of Radio Science 1984-1986*. (Similar reviews were put together for its previous triennial meetings.) The volume, which was edited by Dr. Geoffrey Hyde of Comsat, covers all the major areas of communications, including EMI and bioeffects. The chapters on "EM Noise and Interference" and on "Bioeffects of EM Waves" were assembled by H. Kikuchi of Japan and Cesar Romero-Sierra of Canada, respectively. Each chapter features extensive references. A copy of the review is available for \$20.00, which includes surface postage, from: URSI, 3 Ave. Circulaire, B-1180 Brussels, Belgium.

CONFERENCES

New Listings

May 1-5: **3rd Annual High Frequency Power Conversion Conference**, Princess Resort Hotel, San Diego, CA. Contact: Intertec Communications, Inc., 2472 Eastman Ave., Bldg. #33-34, Ventura, CA 93003, (805) 658-0933.

May 9-13: **4th National Conference on High Power Microwave Technology for Defense Applications**, U.S. Naval Post Graduate School, Monterey, CA. Contact: Kindra Landry, American Defense Preparedness Association, Rosslyn Center, 1700 North Moore St., Suite 900, Arlington, VA 22209, (703) 522-1820.

May 12-17: **Spring Conference of the Society of Telecommunications Consultants (STC)**, Hyatt Regency Alicante Hotel, Garden Grove, CA. Contact: STC, 1841 Broadway, Suite 1203, New York, NY 10023, (212) 582-3909.

June 7-10: **Conference on Precision Electromagnetic Measurements (CPEM'88)**, Tsukuba Science Center, Japan. Contact: CPEM'88 Secretariat, 2-40-14, Hongo, Bunkyo-ku, Tokyo 113, Japan.

June 23-25: **2nd European Congress of NMR in Medicine and Biology**, Hotel Inter-Continental, Berlin, F.R.G. Contact: Dr. C.D. Claussen, Radiologische Klinik, Freie Universität Berlin, Spandauer Damm 130, 1000 Berlin 19, F.R.G., (030) 30 35-821.

June 25-26: **4th National Standing Conference on Low-Level Radiation and Health**, Stirling, Scotland, U.K. Contact: M. Crankshaw, 20 Reedloch Dr., Barrassie, Troon, KA10 6UK, Scotland, U.K., (0292) 316008.

July 5-7: **Military Microwaves '88**, Wembley Conference Center, London, U.K. Contact: Patrick Pinches, Microwave Exhibition and Publishers Ltd., 90 Calverley Road, Tunbridge Wells, Kent TN1 2UN, U.K., (0892) 44027.

October 16-20: **1988 Conference on Electrical Insulation and Dielectric Phenomena**, Skyline Hotel, Ottawa, Canada. Contact: Prof. Marshall Pace, Dept. of Electrical and Computer Engineering, University of Tennessee, Knoxville, TN 37996, (615) 974-5419.

November 9-11: **21st Annual Electronics and Aerospace Conference (EASCON 88)**, Hyatt Regency Crystal City, Arlington, VA. Contact: Wilbur Pritchard, SSE Telecom, 7200 Wisconsin Ave., Bethesda, MD 20814.

April 2-7, 1989: **1989 IEEE/PES Transmission and Distribution Conference and Exposition**, Convention Center, New Orleans, LA. Contact: Donald Preston, Louisiana Power & Light Co., PO Box 6008 (L-319), New Orleans, LA 70174, (504) 363-8735.

September 11-14, 1989: **Work with Display Units 89 (WWDU89)**, Queen Elizabeth Hotel, Montreal, Canada. Contact: WWDU89, Institut de Recherche en Santé et en Sécurité du Travail du Québec, 505 boul. de Maisonneuve Ouest, Montreal, Québec H3A 3C2, Canada, (514) 288-1551.

Upcoming Meetings

May 10-12: **EMC Expo-88**, Washington Hilton Hotel, Washington, DC. Contact: Karen Smith, EMC Expo-88, PO Box D, Gainesville, VA 22065, (703) 347-0030.

May 16-19: **20th Annual Meeting of the Conference of Radiation Control Program Directors (CRCPD)**, Hyatt Regency, Nashville, TN. Contact: CRCPD, 71 Fountain Pl., Frankfort, KY 40601, (502) 227-4543.

May 25-27: **1988 IEEE MTT-S International Microwave Symposium**, New York, NY. Contact: Jesse Taub, LRW Associates, 1218 Balfour Dr., Arnold, MD 21012, (516) 595-4288.

June 19-24: **10th Annual Meeting of the Bioelectromagnetics Society (BEMS)**, Westin Hotel, Stamford, CT. Contact: BEMS, 120 W. Church St., Frederick, MD 21701, (301) 663-4252.

June 28-30: **9th International Wroclaw Symposium on Electromagnetic Compatibility (EMC)**, Wroclaw, Poland. Contact: W. Moron, EMC Symposium, 51-645 Wroclaw 12, Box 2141, Poland.

July 4-8: **33rd Annual Meeting of the Health Physics Society (HPS)**, Sheraton Boston Hotel & Towers, Boston, MA. Contact: HPS, 8000 Westpark Dr., Suite 400, McLean, VA 22102, (703) 790-1745.

July 24-29: **1988 Power Engineering Society Summer Meeting**, Hilton and Marriott Hotels, Portland, OR. Contact: IEEE Society Special Services, 345 East 47th St., New York, NY 10017, (212) 705-7895.

August 2-4: **IEEE 1988 International Symposium on Electromagnetic Compatibility**, Westin Hotel, Seattle, WA. Contact: Don Weber, Hamilton Engineering Inc., 2108 SW 152nd St., Seattle, WA 98166, (206) 244-0952.

telephone interview, "The effect is real. It is produced by a low-level magnetic field, but we don't yet know what the important parameters of the field are."

Monahan's lab was one of the two in which a statistically significant increase in abnormalities was found. The other significant findings were reported by Dr. Alexander Martin of the University of Western Ontario in London, Canada.

Similarly, Dr. Ezra Berman of the Environmental Protection Agency (EPA) in Research Triangle Park, NC, who is coordinating the Henhouse project, told *Microwave News* that, "This study has contributed significantly to the growing data base implicating an association of PMFs of very low frequency and/or very low intensity in the increase of abnormalities in chick embryos."

Berman will discuss the Henhouse results at the *Annual Meeting of the Electromagnetic Energy Policy Alliance* on April 21 in Alexandria, VA, before making the official presentation at the BEMS meeting in Stamford, CT, June 19-24.

In addition to Leal, Martin and Monahan, the other Henhouse researchers are Drs. William Koch of the University of North Carolina (UNC) in Chapel Hill, Kjell Hansson Mild of the National Institute of Occupational Health in Umea, Sweden, and Graciela Martucci, formerly with the EPA in Las Vegas, NV.

The six research teams used identical equipment and similar experimental procedures; only the chick eggs came from different sources. Altogether, they ran a total of 60 experiments. The eggs were exposed to a 1 μ T PMF—each pulse had a 2 μ sec fall and rise time with a 500 μ sec duration—for the first 48 hours of incubation.

BEMS Henhouse Abstract

The effect in chick embryos of exposure to pulsed magnetic fields (PMFs) was investigated by six independent laboratories in Europe, Canada, and the U.S. Each laboratory was identically equipped with incubators containing Helmholtz coils, electrical devices to develop and observe the pulse, and monitors of the temperature, relative humidity, and vibration of each incubator. Each laboratory conducted 10 runs of 20 eggs (10/sham or treated) exposed to unipolar pulsed magnetic fields (1 μ T, 500 μ s duration, 2 μ s rise and fall time, 100 Hz repetition) for the first 48 hours of incubation. Eggs were evaluated for fertility, and embryos for the presence of development, normal structure, and maturity. Two of six laboratories showed a significant ($p < 0.001$ and $p = 0.03$) increase in the proportion of abnormal embryos in the treated group, and so did the project as a whole ($p = 0.001$). The interaction between treatment and laboratory where the experiment was conducted was significant ($p = 0.015$) for the proportion of abnormal embryos. Statistical differences in the proportion of live embryos ($p = 0.01$) and in their maturity, as measured by the number of somite pairs ($p = 0.002$) and the Hamburger and Hamilton stage ($p = 0.005$), were related to the laboratory and not to exposure. Apparently, very low-level, very low-frequency, pulsed magnetic fields contribute to increased abnormality incidences in early embryonic chicks without concomitant changes in maturity. (Supported by ONR and EPA.)

EPA's Ric Tell designed and built the exposure systems, which control all the major physical variables—for instance, temperature, humidity and mechanical stability. Tell, who last year left EPA to open his own consulting firm, told *Microwave News* that, "The Henhouse project probably represents one of the most carefully done experiments...aimed at exploring the biological effectiveness of weak PMFs."

Although the field affected the incidence of abnormalities among the developed embryos, it did not change the ratio of developed to non-developed (alive to dead) organisms or the rate of growth of the morphologically normal embryos. There is no clear explanation for the variation in the experimental results from the six labs.

Leal believes that genetic factors could explain some of the differences. For instance, she said that the one group that did not find an increase in abnormalities—Koch's team at UNC—used a breed of chick eggs which was genetically very different from that used by the other five labs. According to EPA's Berman, Koch exposed White Rock eggs, while the others used White Leghorn eggs. Leal pointed out that the new results reinforce what her group found some years ago—that weak PMFs are effective but that the biological response is modulated by "uncontrolled factors."

In addition, in a paper published last year, Leal and co-workers showed that the teratogenic effect of PMFs depended on the orientation of the chick embryos. They concluded that, "By changing their orientation, the embryos could escape the potential teratogenic effect of a field exposure on their development" (see *Medical Science Research*, 15, pp.531-532, 1987). In a previous paper, Leal's group reported on the influence of the Earth's magnetic field on the development of chick embryos (see *MWN*, January/February 1987).

The Spanish Ministry of Health is sponsoring a meeting for the members of the Henhouse project in Madrid, April 25-29. In addition to planning the next series of experiments, the researchers will discuss possible sources of funding to keep their research going—the ONR money has run out. IBM is considering funding the continued work of the project, according to a company spokesperson.

The impact of the Henhouse results on the debate over possible ill effects among pregnant VDT operators is as yet unclear. The type of PMF used by the Henhouse teams was different from that emitted by the flyback transformer in cathode ray tube-type VDTs, and a chick embryo is quite unlike a human fetus. Not surprisingly, most experts shied away from extrapolating the results to humans and VDTs. As Leal told *Microwave News* from Madrid, "Possible effects of VDT fields on the human fetus can only be known through an epidemiological study."

The spokesperson for IBM also cautioned against applying the chick egg results to other species—especially humans. She said that, "It would seem that the only prudent conclusion to draw at this time from the Henhouse investigation is that further research is needed to better understand electromagnetic fields."

Dave Janes, a division director at the Environmental Protection Agency (EPA) and the chairman of the C95.IV risk assessment group, compared the subcommittee to "a rudderless ship." Asked about the status of the revision of the health standard, Janes told *Microwave News*, "I haven't the foggiest notion in the world."

One of the clouds hanging over the members of C95 is the fear of personal liability if the standard is later contested in court. The Navy and the IEEE have so far refused to indemnify the working members from future legal challenges.

According to Dr. John Osepchuk of Raytheon, the secretary of C95.IV, this lack of protection was a factor in Storm's decision to resign. Indeed, in his letter of resignation, Storm, a hyperthermia specialist at the University of Wisconsin in Madison, advised Rosenthal to consider appointing a chairman of C95.IV from the ranks of industry – and thus protected by his or her company – since "the chairman will be the first-named in a lawsuit against the committee."

Nevertheless, Rosenthal appointed Drs. Om Gandhi of the University of Utah in Salt Lake City and Eleanor Adair of the John Pierce Foundation in New Haven, CT, as interim co-chairs of C95.IV until a new chairman of C95 is appointed.

In a telephone interview, Gandhi said that, "The first order of business is to get some kind of liability insurance for the members." Gandhi believes that over two-thirds of the subcommittee are concerned over liability: "Realistically, concrete action cannot be taken until the liability cloud is lifted."

An IEEE Committee

The most likely solution to the legal dilemma is for C95 to become an IEEE committee. Gandhi said that a petition to the IEEE is being drafted. According to Rosenthal, the petition will be forwarded to the IEEE Standards Board for its June meeting.

Henry Bachman, the past president of the IEEE and a vice president at Hazeltine Corp., said that he would welcome the committee because the radiation issue is of direct relevance to the institute. But, as Andy Salem, the director of standards at the IEEE, pointed out to *Microwave News*, C95 would have to operate under IEEE procedures: "They will have to decide whether to trade their independence for good management."

If C95 does become an IEEE committee, its members will be indemnified, Salem said. However, he added that it is out of the question for the institute to provide funds for the committee's operation – that is up to industries and organizations which have an interest in the standard.

No one anticipates any progress on the revision until the C95 organizational problems are worked out. As Dr. Max Weiss of AT&T Bell Labs said, "Until the bureaucratic situation is resolved, we can't do very much."

Under ANSI's rules, all standards must be revised or reaffirmed every five years. The ANSI C95.1-1982 guidelines are thus already technically out-of-date.

Frustration among the C95.IV membership has mounted since 1983, when Storm first set up a complex system of

committees, subcommittees and working groups to evaluate the RF/MW bioeffects literature (see *MWN*, July/August 1983). The following year, complaints were already surfacing over the unwieldy structure and slow pace of the revision process (see *MWN*, October 1984). After entering the maze for review, some papers seemed to disappear.

Nothing changed, however, and two years later, in Madison, WI, the debate became tense as proposed revisions were announced before the literature review was complete. Many subcommittee members balked at having to vote on the proposals (see *MWN*, July/August 1986).

In Madison, some C95.IV members refused to vote, citing their concerns over personal liability after Navy and IEEE staffers warned that they would not offer them indemnity. Since then, progress has been imperceptible. Storm did not attend last year's C95.IV meeting in Portland, OR.

In numerous interviews, many C95.IV members said they did not know the status of the revision. "As far as I am aware, no progress has been made since June 1987, and, if progress has been made, it has not been communicated to the subcommittee," said Jack Monahan, the C95.IV representative of the Food and Drug Administration's Center for Devices and Radiological Health.

Dr. Barbara Chang, chief of hematology and oncology at the VA Medical Center in Atlanta, GA, quit out of frustration over the group's disorganization. In her February 18 letter of resignation, Chang, one of the few medical doctors active on C95.IV, complained that, "Not only have we not received all of the articles we should have received in a timely fashion, but an organized effort at obtaining our reviews in a systematic, uniform manner has not been undertaken."

Substantive Issues

Once the organizational details are worked out, the C95.IV members must grapple with a host of equally complex technical and policy questions. For instance, the subcommittee still has not decided whether to adopt a two-tier standard with different limits for the general population and for workers – like the one recommended by the National Council on Radiation Protection and Measurements (NCRP). The 1982 ANSI guidelines applied the same limits to both groups. Also, there are proposals to extend the applicability of the standard down to 3 kHz and up to 300 GHz. At present, it only covers the 300 kHz-100 GHz frequency band.

The appointment of Gandhi as interim cochair will complicate the negotiations over loosening the 1982 limits at millimeter wave frequencies. In 1986, a proposal was offered to double the standard to 10 mW/cm² above 3 GHz – apparently to conform to infrared radiation exposure limits (see *MWN*, July/August 1986). But Gandhi has strongly criticized this change, arguing that millimeter waves and infrared radiation are very different because the former can penetrate clothing while the latter cannot. Asked whether he will maintain his opposition to relaxing the standard at higher frequencies, Gandhi replied, "Of course. I'm not giving up science."

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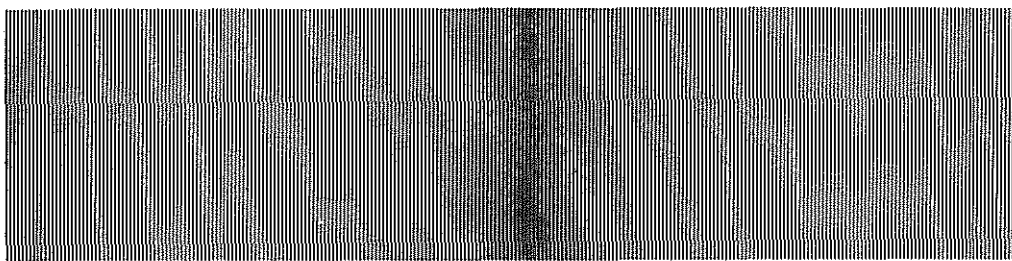
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MICRO WAVE NEWS



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A Report on Non-Ionizing Radiation

March/April 1989

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NAS-NRC: Skepticism over ELF Effects Without a Mechanism

At a March 14 workshop, members of a panel convened by the National Academy of Sciences-National Research Council (NAS-NRC) expressed skepticism about the possible role of weak extremely low frequency (ELF) fields in the development of cancer. "We have not seen good basic research that could explain the epidemiological findings," Dr. Richard Setlow, the chairman of the panel, said in a telephone interview after the meeting.

After six invited speakers presented an overview of current ELF research, the three physicists on the NAS-NRC panel—Drs. Robert Pound, Herman Schwan and Eugene Stanley—all expressed doubt that low-intensity fields could be responsible for the observed increases in cancer rates.

"Is there an effect?" Stanley asked rhetorically. For his part, he said that he is far from convinced. Stanley expressed his amazement at "the lack of coordination among studies," while acknowledging that the "main problem is a lack of funding." Nevertheless, he said that, "It's worth the agencies' money" to find out if there are health effects. He added that he would prefer science-based agencies like the National Institutes of Health and the National Science Foundation to sponsor ELF studies, rather than the Electric Power Research Institute (EPRI) and the Department of Defense, which have a stake in the results.

Those members of the panel with biological and epidemiological expertise had their own criticisms. For instance, Dr. Clark Heath described

(continued on p.14)

Florida Adopts First U.S. Power Line Magnetic Field Limits

Rules Are Challenged as Too Lax

The state of Florida has adopted the first power frequency magnetic field exposure standards in the United States. The magnetic field limits set by the state Department of Environmental Regulation (DER) are significantly weaker than those first proposed last year.

The standards, adopted at a January 18 public meeting, only apply to new transmission lines, but the regulations also specify more stringent limits for the 500 kV Lake Tarpon-Kathleen power line—the line is certified to operate at only 16% of its capacity, however.

"These are not health-based standards," the DER's Buck Oven told *Microwave News*. "Since at this point, we can't say what levels are safe, the standards are set on what is technologically achievable."

But residents of Hillsborough County—the site of the planned Lake

(continued on p.13)

HIGHLIGHTS

Commerce Department and FCC Seek EPA RF/MW Rules

The National Telecommunications and Information Administration (NTIA), an arm of the Department of Commerce, has joined the chorus of those agencies trying to convince the Environmental Protection Agency (EPA) to issue federal standards for public exposures to radiofrequency and microwave (RF/MW) radiation.

In a February 24 letter to EPA Administrator William Reilly, Assistant Secretary of Commerce Alfred Sikes argued that, "It is important and in the public interest that the EPA continue its RF radiation activities and issue federal guidance."

Also, the Federal Communications Commission (FCC) has again expressed its "disappointment" that the EPA will not issue RF/MW limits. In a March 14 letter to the EPA, FCC Chief Engineer Thomas Stanley asked the EPA to consider developing an official position on nongovernmental safety standards that either have been or will soon be issued: "It would be of great benefit to the FCC and other agencies if the EPA would offer advice on the interpretation and supportability of existing nongovernmental RF standards." Stanley explained that, "In the next two years, the FCC may have to reconsider which nongovernmental RF exposure standard to use."

Last November, FCC Chairman Dennis Patrick asked the EPA to reconsider its decision to defer its rules (see *MWN*, N/D88). The FCC, like the NTIA, is concerned that without federal rules, state and local governments will issue "unduly restrictive" exposure standards. In its January 23 response, the EPA offered no encouragement that RF/MW limits might be forthcoming, but did say that the agency may publish a "Citizen's Guide" to RF radiation.

Stanley asked in the March letter whether the proposed citizen's guide would offer clues as to "what are considered to be 'safe' exposure levels?" He went on to express concern that the "EPA will lose the expertise necessary to maintain the interagency agreement and satisfy future demands to measure and analyze environmental RF exposure."

NTIA's Letter

In NTIA's letter to the EPA, Sikes was relaying the concerns of the Frequency Management Advisory Council (FMAC), an NTIA advisory committee. At its November 14 meeting, FMAC was briefed by Richard Guimond, the director of EPA's Office of Radiation Programs, who had decided to put the RF/MW rules on hold after more than ten years of development (see *MWN*, S/O88 and J/F89). Also present was Dr. Charles Süsskind of the University of California at Berkeley, who maintains that there is a clear constituency for a uniform, nationwide standard.

Members of FMAC decided to send the letter to the newly-installed EPA administrator. Dr. Sam Koslov of the Johns

Hopkins University Applied Physics Lab was recruited to draft the letter, which advised the EPA that:

Authoritative federal criteria are needed both as a basis for assuring safety and to prevent the costly and disruptive effect that the proliferation of piecemeal and diverse exposure criteria and regulations are having on the telecommunications industry. The absence of such criteria also contributes to public apprehension, litigation and controversy over the safety of RFR [RF radiation] and radiating equipment. Furthermore, other countries, large and small, have established or are developing standards to control exposures to RFR. International bodies have also recommended guidelines. U.S. companies competing to provide equipment and telecommunications services in world markets face uncertainties in complying with diverse criteria established by other countries or international bodies. Without established U.S. criteria as a basis for leadership, the U.S. weakens its position.

We appreciate the demands of other important priorities competing for the limited budgetary and manpower resources available to EPA. However, considerable investment, effort and substantial progress have been made toward the issuance of RFR guidance by the EPA since the 1970s. Very little more is needed to complete the task at this stage as compared with the significant effort and additional resources that will be required to re-establish the activity later. We believe it is important and in the public interest that EPA continue its RF radiation activities and issue federal guidance.

DOD Launches Inter-Service EMI Study Project

The U.S. Department of Defense (DOD) has begun a three-year study of electromagnetic compatibility among electronic weapons systems used in the different branches of the military. The \$30 million joint electromagnetic interference (JEMI) study project is headed by the U.S. Air Force's (USAF) Colonel Charles Quisenberry of the Tactical Air Warfare Center at Eglin Air Force Base (AFB) in Florida.

Quisenberry, who recently completed a seven-month, classified JEMI feasibility study, has stated that the investigation was prompted by the unexplained crash of a USAF F-111 jet during the 1986 raid on Libya, according to a January 19 Knight-Ridder news service report. Quisenberry said that radiofrequency (RF) interference might have led to the downing of the F-111: "It could have. We couldn't rule it out or say that that was the cause," Knight-Ridder reported.

Speculation that EMI was responsible for the F-111 loss was further fueled by an account of the incident by former Secretary of the Navy John Lehman, Jr. in his recently-published book, *Command of the Seas*. Lehman wrote that Navy pilots saw the F-111 crash into the water off the coast of Libya and then explode, but there was no indication that it had been hit, the February 13 *Air Force Times* reported.

After a detailed investigation, the USAF determined that the crash and other unexplained problems during the raid were due to a flood of electronic signals from Navy and USAF high power transmitters intended to jam Libyan air defenses: "The end result was we found out [that] we did it to our-

Navy Signals Jam Automatic Garage Door Openers

For two weeks in March, a mysterious signal jammed hundreds of radio-controlled garage door openers in the San Francisco Bay Area. The puzzle was solved on March 16 when the U.S. Navy announced that the electromagnetic interference (EMI) was caused by shore-to-ship communications. The Navy stopped its transmissions on March 15.

Using an antenna atop Mount Diablo, the Navy was transmitting at 311.6 MHz, according to Lt. John Murphy, a spokesman at the San Francisco Naval Base. Garage door openers operate in the 308-312 MHz frequency band.

When news of the EMI got out, the Navy was besieged with calls. "I was even contacted by the British Broadcasting Corporation (BBC)," Murphy told *Microwave News*. Murphy believes that widespread interest was sparked by rumors that the source of the EMI was top secret. "The BBC even asked about a link with the [NASA] shuttle," he said. He added that the transmissions were not classified. The rumors were no doubt fueled by a Federal Communications Commission spokesman who refused to divulge which governmental agency was responsible for the interfering signals.

The Navy usually uses telephone lines to communicate with its docked ships, Murphy pointed out, but there was a break in the system, which has since been repaired. Alternative means are being investigated for the future, Murphy said. "We don't want to be a bad neighbor."

In 1986, a similar problem occurred in southern California when President Reagan's E-4B—a specially-equipped Boeing 747 to be used in the event of nuclear war—caused garage door openers to malfunction (see *MWN*, M/J86).

selves," Quisenberry told Knight-Ridder.

A Pentagon spokesman, quoted in the February 13 *Air Force Times*, refuted Quisenberry's claims: "There is no indication...that EMI might have caused one of the fighters to crash and others to miss their targets, or that during the Libyan strike U.S. weapons were interfering with each other."

Quisenberry is no longer granting telephone interviews, a DOD spokeswoman told *Microwave News*.

The JEMI project, which is staffed by approximately 65 military and civilian experts at Eglin AFB, is the first major effort to investigate how RF signals from the weapons of one branch of the military might disrupt the electronics systems of another branch.

Among the goals of the project are to notify U.S. and allied commanders of potential problems and to recommend tactics to avoid them, either by assigning new frequencies to certain

transmitters or by assuring that interfering weapons are kept far enough apart to prevent EMI, according to Knight-Ridder.

Quisenberry has proposed using the U.S. Army's UH-60 Black Hawk helicopter as a case study, according to the December 19, 1988, *Aviation Week & Space Technology*. The Black Hawk has been identified as vulnerable to EMI and has been implicated in a number of possible EMI-related accidents (see *MWN*, N/D87, S/O88 and N/D88). Another Army helicopter under investigation for susceptibility to EMI is the AH-64 Apache. A June 20, 1988, report from the DOD Inspector General pointed out that simple solutions to EMI do not always work: coating the doors of the Apache with a metallic paint did not solve the problem.

The DOD hopes to institutionalize the JEMI project after the three-year investigation is concluded, according to the December 19 *Aviation Week*.

EMI among military systems has become national news: On February 27, *Time* ran an item on the PAVE PAWS radar at Robins AFB, GA—where the main beam of the phased array poses a threat to electro-explosive devices aboard aircraft flying into the base—under the headline, "A \$90 Million Mistake" (see *MWN*, J/A88, N/D88 and J/F89). The magazine also referred to the EMI problems plaguing the Black Hawk.

Higher Cancer Rates Near San Francisco's Sutro Tower

Between 1973 and 1985, in San Francisco's Noe and Eureka valleys, children under the age of 15 developed cancer at twice the expected rate for children in the Bay Area. The San Francisco Department of Public Health, which conducted a brief investigation, believes that the statistically significant increase (21 observed cases, as compared to 11.8 expected) may have occurred by chance. The department points out that there is no evidence of a continuing problem, since no new cases have been reported since 1986.

The search for the cause of the problem has yielded two potential candidates: radiofrequency (RF) radiation from the Mount Sutro tower—shared by five VHF and four UHF TV stations and four FM radio stations—atop Twin Peaks, which overlooks the Noe and Eureka valleys, and radioactive and toxic chemical emissions from the nearby University of California-San Francisco Medical Center. The wind patterns in the area argue against the emissions as the culprit, however.

In both April and December 1988, at the request of Sutro Tower Inc., engineers from Hammett & Edison, a San Francisco-based consulting firm, measured RF radiation levels near the tower and in the Noe and Eureka valleys. Typical values in publicly accessible areas close to the tower were in the 3-10 $\mu\text{W}/\text{cm}^2$ range—the highest reading was 530 $\mu\text{W}/\text{cm}^2$ in a small area near a lamppost. (Similar readings were found in a 1985 survey.) In the Noe and Eureka valleys, typical readings were 0.5 $\mu\text{W}/\text{cm}^2$, with a maximum of 2.6 $\mu\text{W}/\text{cm}^2$.

HIGHLIGHTS

William Hammett, who took the December 1988 measurements, told *Microwave News* that the city of San Francisco had recently run its own RF survey and had obtained similar readings.

The city Department of Public Health said that it will continue to monitor the rates of childhood cancer.

FCC Proposes Revising EMI Measurements for Computers

The Federal Communications Commission (FCC) has proposed revising its rules for measuring electromagnetic emissions from digital devices such as computers. The revised rules, *FCC Procedure for Measuring Electromagnetic Emissions from Digital Devices*, FCCIOET TP-5, known simply as TP-5, will replace the existing measurement rules, MP-4, adopted in 1983 (see *MWN*, S83).

Under the TP-5 proposal, different procedures are specified for measurements of conducted and radiated emissions from tabletop devices and from floor-standing and other large digital devices.

The proposed changes were prompted in part by a 1987 petition from the Computer Business and Equipment Manufacturers Association (see *MWN*, M/J87 and S/O87). The FCC also notes the fact that the "computer industry has changed dramatically since 1980 in ways that affect how computers are tested." The notice of proposed rulemaking was released on March 7.

EPA Measures RF Radiation in McFarland, CA

A preliminary analysis of measurements taken by a team from the Environmental Protection Agency (EPA) indicates that the primary source of ambient radiofrequency radiation in McFarland, CA, is UHF television signals, with a smaller contribution coming from the Voice of America (VOA) station in nearby Delano. The levels were in the nanowatt per square centimeter range.

Norbert Hankin and Ed Mantiply, both of EPA's Office of Radiation Programs, took extensive measurements in McFarland and in and around the Delano VOA station March 6-16, with the assistance of staffers from the VOA and from the National Telecommunications and Information Administration. A report is in preparation and should be available by late summer.

The EPA measurements were made at the request of the California Department of Health Services as part of its continuing effort to identify the cause of a cancer cluster among the children of McFarland (see *MWN*, J/F88 and S/O88).

Recent FCC tests of digital devices found that a "significant percentage" of the equipment did not comply with the commission's RF emission limits. The FCC hopes that by providing additional guidance and clarification, the compliance rate will improve and that the new procedures will facilitate more efficient testing and reduced compliance costs.

Some people have argued that the FCC should go further and adopt the recommendations in *CISPR Publication 22* for controlling interference; a number of European countries have already done so. The FCC is requesting comments as to whether its emission limits and test procedures should conform to those of CISPR.

Comments are due by May 8 and reply comments by June 7. Contact: Hugh Van Tuyl or Richard Fabina, FCC Lab, 7435 Oakland Mills Rd., Columbia, MD 21046, (301) 725-1585.

U.S.S.R. Meetings on ELF, MWs and MM Waves

U.S. scientists have been invited to attend an international symposium on *The Fundamental Aspects of the Application of Millimeter-Range Electromagnetic Radiation in Medicine*, to be held in Kiev, U.S.S.R., May 10-13. The meeting is being organized by Professor S.P. Sitko; papers will be presented in Russian, Ukrainian and English.

"This is the first time they have opened up this type of meeting to Americans," Dr. Om Gandhi of the University of Utah in Salt Lake City told *Microwave News*. He noted that, while work in this area has virtually ceased in the U.S., the Soviets are continuing their studies. "They continue to believe in frequency-specific effects of millimeter waves," he said.

Neither Gandhi nor Dr. Shirley Motzkin of the Polytechnic University in Brooklyn, NY, both of whom were invited to the Kiev meeting, has yet been able to secure travel funds. Without travel grants, both said that they will be unable to attend.

And next September 25-30, Soviet and U.S. scientists will meet in Uzhgorod in the Soviet Ukraine as part of a continuing U.S.-U.S.S.R. cooperation program. Workshops are held every two years (see *MWN*, M85 and J/A87).

According to Jack Monahan of the Center for Devices and Radiological Health at the Food and Drug Administration in Rockville, MD, the workshop will focus on biological effects at extremely low and microwave frequencies. Last year, Monahan took over as the U.S. coordinator of the U.S.-U.S.S.R. program from Dr. Don McRee, whose agency—the National Institute of Environmental Health Sciences—stopped sponsoring its own non-ionizing radiation research (see *MWN*, J/A87).

In addition to Monahan, those invited to attend the Uzhgorod workshop are: Drs. Larry Anderson, Carl Blackman, Reba Goodman, Bill Guy, Imre Gyuk, Henry Kues, Henry Lai, Mary Ellen O'Connor and Howard Wachtel.

« Power Line Talk »

The controversy continues over a power line built by the Irish Electricity Supply Board in County Wicklow. In January, the line was energized after the Minister for Energy, Michael Smith, received a report prepared by his chief technical advisor, Dr. Tom McManus, who found "no health risk on the basis of present knowledge." *Electromagnetic Fields from High Voltage Transmission Lines* concludes that, "There is no scientific basis at this time to justify a further delay to the energizing of the Carrickmines-Arklow 220 kV transmission line." The 35-mile power line, which reportedly cost £9.5 million (IR), is located near two schools (and many homes)—it replaces an existing 110 kV line along the same right-of-way. The November 1988 report notes that the calculated maximum magnetic fields near the two schools are approximately 20 and 40 mG; the calculated maximum electric field levels are less than 4 kV/m. Smith called for an independent assessment following protests from concerned county residents and a citizens' group called SPARKS—Stop Powerlines Across Residences, Kindergartens, and Schools (see *MWN*, S/O87). SPARKS's John Royds called the report a "whitewash" and in a letter to the *Irish Times* (February 7) rejected it because "it contains flaws, omissions and is biased." Royds questioned how the report can be "independent" when it was written by the minister's own advisor. SPARKS is preparing a detailed response to the report and, in the meantime, is fighting for the line to be "switched off during school hours as an interim measure." Copies of the report are available for £12 (IR), including shipping and handling, from: Government Publications Sales Office, Sun Alliance House, Molesworth Street, Dublin 2, Republic of Ireland. The check must be in Irish currency.

«« »»

The deadline for responses to the National Cancer Institute's (NCI) requests for proposals (RFPs) for its study of the etiology of childhood cancer and EMFs has been extended. Proposals are now due by April 6. Meanwhile, the investigation into the possible ethical violations by NCI staffers testifying at power line hearings and trials continues.

«« »»

Through the years a number of people have speculated over a possible association between sudden infant death syndrome (SIDS) and EMF exposure. Recently, the *Sunday Mirror*, a British tabloid, has turned the issue into a crusade featuring a series of articles on "cot death" and its link to power lines, radar and microwaves. The headlines have been sensationalistic: for instance, "Rays of Death: Electro Waves Clue to Cot Tragedy Babies" and "Meter Goes Haywire in New Tests." Roger Coghill and Dr. Cornelia O'Leary, both of Coghill Research Associates, a London-based consulting firm specializing in EM pollution, started the frenzy in January with seminars on "Electropollution: The Hidden Threat to the Planet."

The *Sunday Mirror* reported that research has been ignored because the medical world is "too frightened of its implications." On January 29, the tabloid's reporter Paul Scott and Coghill blamed "a cluster of anguish" on radar radiation from the Farnborough Air Force Base. In a February 12 follow-up, Scott quotes Coghill: "The poor babies were bombarded with incredibly powerful electromagnetic waves. They didn't have a chance." The *Mirror*'s editors, believing they were on to something important, sent Scott and Coghill 6,000 miles to Rohnert Park (near Santa Rosa), CA, where there has been another cluster of SIDS cases. In a March 12 item, Scott dubbed the area "the electromagnetic capital of the world," and reported that, "Once again we have discovered important evidence that the babies were killed when they were exposed to dangerously high levels of magnetic waves." On February 19, the *Sunday Mirror* also reported that Lord Laurence Olivier had called in Coghill to test the bedroom of his eight-month-old grandson for electromagnetic waves. After being given the "all clear sign" by Coghill, Olivier said, "We must make sure that people like Mr. Coghill are given enough money to carry out this important work." According to the *Sunday Mirror*, Olivier is planning to come out of retirement to narrate a television series about the "harmful effects of the waves."

«« »»

Planners have joined the ranks of those concerned about potential EMF health effects. Joel Goldsteen, a city and regional planner at the University of Texas in Arlington, wants other planners to be aware of the potential public health hazard posed by power line EMFs. In the January 1989 issue of *Planning*, the journal of the American Planning Association, Goldsteen concludes—after plotting the paths of power lines in the Dallas-Fort Worth metropolitan area and taking into account statistics from recent research showing increased cancer risk among people living within 500 feet of high-voltage lines—that "some seven percent of the area's residents could at some point be negatively affected by the EMFs of overhead power lines." Goldsteen notes that some planners have promoted the idea of using power line rights-of-way as "parklike 'amenities.'" He suggests that, in the future, planners may have to employ environmental risk assessment methods, such as considering epidemiological studies on EMF-cancer risks, when siting new schools.

«« »»

On March 13, the entire Hydro-Québec power grid went down, knocking out electrical service to almost six million people and the Montréal subway system, according to the Associated Press. The power failure, which reportedly was triggered by a magnetic storm from a solar flare, was the third "province-wide" power failure this year. Some people blame the system's vulnerability on Hydro-Québec's large power sales to the northeast U.S.

Swedish Academy of Sciences To Review ELF Effects

The Royal Swedish Academy of Sciences has invited a group of international experts to Stockholm, May 25-27, to review the biological effects of extremely low frequency (ELF) fields. The objectives of the workshop are "to critically scrutinize possible mechanisms and to try to evaluate the significance of experimental findings," according to the academy.

Scheduled speakers at the meeting on *Interaction Mechanisms of Low-Level Electromagnetic Fields in Living Systems—Resonant Phenomena* include Drs. Ross Adey of the Veterans Administration in Loma Linda, CA, P. Bayley of the National Institute for Medical Research in London, U.K., Carl Blackman of the U.S. Environmental Protection Agency in Research Triangle Park, NC, Alessandro Chiabrera of the University of Genoa in Italy, Michel Coleman of the International Agency for Research on Cancer in Lyons, France, Carl Durney of the University of Utah in Salt Lake City, Reba Goodman of Columbia University in New York City, Yngve Hamnerius of the Chalmers University of Technology in Gothenburg, Sweden, Abraham Liboff of Oakland University in Rochester, MI, Robert Liburdy of the Lawrence Livermore Labs in Berkeley, CA, Herman Schwan of the University of Pennsylvania in Philadelphia and Bruno Zimm of the University of California at San Diego.

The meeting, which is by invitation only, will be chaired by Professor Claes Ramel of the academy's environmental committee. For more information, contact: Dr. Hans Lundberg, Environmental Secretary, Royal Swedish Academy of Sciences, PO Box 50005, S-104 05, Stockholm, Sweden, (46) 8-150430.

EPRI R&D Budget for EMFs: \$21.9 Million for 1989-1991

The Electric Power Research Institute (EPRI) has increased its budget for research and development (R&D) on electromagnetic fields (EMFs) to \$21.9 million for 1989-1991. EPRI has allocated \$7.1 million for 1989, \$7.6 million for 1990 and \$7.2 million for 1991.

The institute's EMF budget is now more than twice the Department of Energy's (DOE) \$3.0 million EMF bioeffects research budget for fiscal year 1989 (see *MWN*, S/O88). EPRI and the DOE are the primary sources of EMF research funds in the U.S.

Last year, EPRI predicted it would spend only \$6.0 million in 1989 and 1990; the new budget represents an almost 20% increase (see *MWN*, M/A88). Of the \$21.9 million, \$16.4 million is for EPRI's Environment Division and \$5.5 million

is for its Electrical Systems Division.

The \$21.9 million does not include funds for staff and support, according to EPRI's Dr. Stan Sussman. EPRI's total R&D budget for 1989-1991 is \$865 million.

These statistics appear in *EPRI Research and Development Program 1989-1991*, which is available free to EPRI members, for \$50 for others in the U.S. and for \$70 outside the U.S. from: Susan Rapone, EPRI, PO Box 10412, Palo Alto, CA 94303, (415) 934-4212.

Review Finds "Consistency" to Cancer Risk in Epi Studies

There is a certain consistency to the observed link between exposures to electromagnetic fields (EMFs) and cancer in both residential and occupational epidemiological studies, according to Dr. Anders Ahlbom of the Swedish Institute of Environmental Medicine in Stockholm. The data "strongly suggest" the need for further research, he concludes.

Writing in the *Scandinavian Journal of Work and Environmental Health* (14, pp.337-343, 1988), Ahlbom presents the most detailed review to date of the nine published residential EMF epidemiological studies and finds that, "Given the different study designs, time periods and locales, the findings of the studies do appear to be rather consistent."

With respect to the ongoing debate on the use of wire codes to estimate residential EMF exposures, Ahlbom writes, "As long as the wire coding system is applied in the same way to cases and non-cases, any exposure misclassification can only mask a true effect; it cannot give rise to a spurious effect."

The results of the adult residential studies, when combined, do not provide much evidence for an association, he notes, but he adds that the residential studies "should be considered in tandem with the studies on occupational exposure, and when their results are combined, indeed, an association cannot be disproved."

Ahlbom takes a briefer look at the occupational studies, noting that the literature in this area has been reviewed "thoroughly by others." He concludes that, "Despite the obvious limitations of these studies and the somewhat erratic findings, it is difficult to avoid the conclusions that there is a certain consistency between the results and that it seems likely that these occupations are in fact at an increased risk of leukemia."

He cautions, however, that, based on current data, no conclusion can be drawn about the role of EMFs in the origin of cancer.

Ahlbom was a member of the advisory panel to the New York State Power Lines Project (see *MWN*, J/A87) and is himself directing an ongoing major epidemiological study on power line cancer risks in Sweden (see *MWN*, M/J87).

The contractors and their topics are: Dr. John Peters of the University of Southern California School of Medicine on epidemiological studies; Dr. Asher Sheppard of the VA Hospital in Loma Linda, CA, on lab data and biophysical models; Dr. Kurt Salzinger of the Polytechnic University in Brooklyn, NY, on behavioral effects; Dr. Kenneth Groh of the Argonne National Lab on circadian rhythms; Dr. Neil Chernoff of the Environmental Protection Agency on reproductive and developmental effects; Dr. William Feero of Electric Research and Management on exposure assessments; and Drs. Lee Rosen and William Wisecup of W/L Associates on programs and funding efforts worldwide. W/L Associates will also cover those research areas not addressed by the other reports.

In its report, the PUC will summarize the information supplied by the contractors and make recommendations with regard to future studies and the potential need for exposure guidelines, Murley said. The contractors' reports will be appended to the PUC report. In addition, the PUC has invited the Electric Power Research Institute to submit a report on its own research; it also will be appended to the PUC report.

This summer, the PUC will hold public meetings in San Francisco, Los Angeles and Sacramento, Murley said, adding that additional meetings may be scheduled if the need arises.

Planning is also underway as to which projects will be funded by the \$2 million allocated for research on biological effects of power line fields.

Maryland: Experimental Research

The Department of Natural Resources is considering sponsoring laboratory research on power line EMFs, according to Thomas Magette of the department's Power Plant and Environmental Review Division in Annapolis. Magette, who is serving as the project manager, told *Microwave News* that the agency is "entertaining several proposals" for experiments using 60 Hz magnetic fields, but no decisions have yet been made.

The project, which is tentatively set to begin in the late summer or the early fall, is envisioned as a one-year study, but it may become an ongoing effort.

Virginia: Annual Report Issued

The Virginia Department of Health recently released its fourth annual report on power lines, which concludes that "recently published literature does not perspicuously demonstrate that exposure to electric and/or magnetic fields in the magnitude produced by high voltage transmission lines is causally associated with cancer or any other long-term detrimental effects in humans."

The 12-page report, *Monitoring of Ongoing Research on the Health Effects of High Voltage Transmission Lines*, prepared by the department's Dr. Khizar Wasti, presents an overview of relevant literature published in 1987-88, including, among others, Dr. David Savitz's childhood cancer study, Dr.

NY DOH on Electric Blankets

On February 9, the Fox Network's *Ten O' Clock News* ran a story on the potential risks of magnetic fields from electric blankets. The segment, which featured Dr. David Carpenter of the New York State Department of Health (DOH), referred people to the DOH for more information. The next day, according to Fox reporter Dr. Joanna Shaw, the DOH received over 350 telephone calls—prompting a followup story on Fox's February 10 broadcast. The following is an excerpt from a question-and-answer fact sheet which the DOH sent out to callers.

- Q. Do electric blankets, or waterbed heaters, cause cancer?
A. No one knows for sure. Electric blankets, waterbed heaters and other electric appliances in the home give off magnetic fields. There have been some scientific studies which suggest—but do not prove—a link between some cancer and the magnetic fields coming from power lines. Some scientists suspect that home appliances could be hazardous in the same way.
- Q. Do electric blankets produce large magnetic fields?
A. Yes. The magnetic field experienced by the human body under an electric blanket is approximately four times larger than that measured in the homes where higher cancer rates were associated with power lines in the street.
- Q. Do blankets constantly expose people to magnetic fields?
A. No. The fields are only generated when appliances are turned on. Also, the strength of the field falls off rapidly with distance away from the appliances. Electric blankets, mattress pads and waterbed heaters create a lot of exposure because people often stay in close contact with them for a long time (all night).
- Q. Should I stop using electric blankets? Waterbeds? Mattress pads?
A. Some people have done that. Others have not. That is a choice for individuals and families to make. The [DOH] is not making any official recommendations. People have to weigh the possible risks, the alternatives available, and any other factors which may be important to them. You may wish to use your electric blanket to warm your bed and then turn it off before getting in.
- Q. What about the risk to pregnant women?
A. Developing fetuses are more susceptible to many environmental risks than are other persons. Women may wish to consider reducing their exposure to magnetic fields during pregnancy.

Margaret Speers's occupational study of electrical workers and the World Health Organization's report on magnetic fields.

The reports are submitted annually to the Virginia General Assembly by order of state Senate Joint Resolution No. 126, which was approved in 1985 (see *MWN*, J/F86). For more information, contact: Dr. Khizar Wasti, Bureau of Toxic Substances Information, Virginia State Health Department, 109 Governor St., Richmond, VA 23219, (804) 786-1763.

Power Line Actions Across the U.S.

All over the U.S., states are taking action to learn about the potential health effects of electromagnetic fields (EMFs) from power lines. At a time when Florida has adopted power line magnetic fields standards (see p.1), some state legislatures and agencies are simply asking for literature reviews. Others, such as California and Maryland, are being more ambitious and are funding their own laboratory studies. Below is a roundup of the latest actions from across the country.

Oregon: Strict EMF Limits Proposed

The Oregon Department of Human Resources (DHS) will have to adopt interim magnetic and electric field standards of 2 mG and 1 kV/m, respectively, for high-voltage power lines by December 1, 1989, if House Bill No.2932 is passed by the state legislature. Oregon currently has only an electric field standard of 9 kV/m.

The proposed magnetic field limit is the strictest ever proposed in the U.S.—it was adapted from a similar bill introduced in the Washington state senate earlier this year. The Washington bill has since been completely rewritten and all mention of EMF standards has been dropped (see below).

The Oregon House bill was introduced on February 23; a public hearing was scheduled for March 27. The bill is sponsored by Representative Nancy Peterson.

Among the bill's other requirements are that the DHS would evaluate the impact of EMFs on workers and on the environment and report back to the legislature by June 1990. The department would set up a panel to determine whether EMF exposures present an "unreasonable cancer risk." The panel would then submit a report describing the health risks associated with residential EMF exposures and listing high-priority research projects needed to better understand them.

At the same time that the state legislature is weighing action, the state Department of Energy is conducting its own EMF research review. David Stewart-Smith of the department's Nuclear Safety and Energy Facilities Division told *Microwave News* that he has put together a five-member panel to evaluate existing literature reviews. The panel will pass its findings on to the Energy Facilities Siting Council, an independent state agency which has the authority to set standards. Stewart-Smith said that the budget for the review is approximately \$10,000-12,000.

Washington: Literature Review Sought

Senate Bill No.5275 would require a literature review of ongoing studies on EMF effects by the Washington State Institute for Public Policy, with the assistance of the Oregon Department of Energy. The bill, which would appropriate \$10,000 for the review, calls for the institute to issue a report to the senate Committee on Energy and Utilities by December

1, 1989.

The senate approved the bill on March 8; it awaits action by the state assembly.

In its original form, the bill, which was sponsored by Senators Eleanor Lee and Phil Talmadge, sought the adoption of interim standards for power line EMFs as well as a study by a state epidemiologist of the impact of EMFs on workers and on the environment (see *MWN*, M/J88).

New York: Reducing EMFs

New York state utilities will soon complete plans for surveying EMFs around power lines and for developing ways of reducing the magnetic fields. The effort, which is being coordinated through the New York City-based Empire State Electric Energy Research Corp. (ESEERCO), is required by an April 1988 order from the NY Public Service Commission (PSC). It follows the recommendations of the PSC's EMF task force report, which in turn was prompted by the final report of the NY Power Lines Project (see *MWN*, M/A88).

The first phase of the project will be to characterize magnetic fields and then examine ways to reduce them. The next step will be to initiate projects to remedy problems identified in the first stage.

The survey data on 345 kV power line magnetic fields will be submitted to the PSC and will then be fed into a computer database. A technical conference, which was also ordered by the PSC last year, will be held this summer. The meeting will be open to the public, according to the PSC's Dan Driscoll.

Plan for Surveying Electric and Magnetic Fields from Overhead and Underground Power Lines in New York State and Research Plan on Reducing Magnetic Fields Associated with Power Delivery and Use will be published as one document and should be available by the end of April, ESEERCO's Herb Kaufman told *Microwave News*.

California: PUC Report Delayed

The Public Utilities Commission's (PUC) report on power line EMF effects, originally due on March 15, will now be submitted to the state legislature by September 15. Last year the legislature instructed the PUC and the state Department of Health Services to submit reports on "cancer and other medical risks which may be related to exposure to [EMFs] produced by electrical utility facilities" (see *MWN*, M/J88, S/O88 and N/D88).

Over the past six months, the PUC has hired seven contractors to submit eight reports on power line EMFs. The reports are costing the PUC \$56,000. The money comes from the PUC's own budget, rather than from the \$2 million allocated by the legislature for health research, the PUC's Clyde Murley told *Microwave News*.

HVDC Power Line and Agriculture Study: No Effects

There is "no evidence that a ± 500 kV DC transmission line caused any effects on cattle or crops that would impact commercial farming or ranching operations," according to a new study sponsored by the Bonneville Power Administration (BPA) in Oregon.

While acknowledging that no single study can resolve all the questions about potential high voltage (HV) power line biological effects, the recently-released *Joint HVDC Agricultural Study* concludes that the results, taken with existing research, indicate that "it is unlikely that HVDC transmission lines cause adverse effects on plants, animals or people."

In one part of the Oregon project, 100 cows and six bulls were confined in pens directly under the line; the same number were kept in similar pens away from the line. No significant differences were observed in body weight, number of calves born or behavior—except that 1-4% fewer exposed

cattle remained in areas directly under the line than in the corresponding areas in the control pens. The reason for this was not determined.

The three-year \$1.7 million study at the Pacific Intertie power line was run by a team led by Robert Raleigh of Oregon State University in conjunction with the BPA, with assistance from the Electric Power Research Institute and from the Department of Energy. In addition, nine other utilities from around the country supported the project "because of renewed interest in the use of DC lines."

For more information, contact: Jack Lee, Project Coordinator, BPA, PO Box 3621-EFBG, Portland, OR 97208.

Also, Professors James Hornig and John Walsh, both at Dartmouth College in Hanover, NH, are working on a three-year, \$400,000 project to study electric and magnetic fields and ion concentrations surrounding a new ± 465 kV DC line which runs from Canada to Massachusetts. The state of New Hampshire is sponsoring the project. Hornig, a chemist, and Walsh, a physicist, will monitor the line for one year before and two years after the line is energized.

ELF and Power Line Resources

J.H. Bernhardt, "The Establishment of Frequency Dependent Limits for Electric and Magnetic Fields and Evaluation of Indirect Effects," *Radiation and Environmental Biophysics*, 27, pp.1-27, 1988.

The author, who is with the Institute for Radiation Hygiene in Neuherberg, F.R.G., and a member of IRPA's non-ionizing radiation committee, outlines a biophysical model—the basis for certain German standards—for determining EMF exposure limits for 50/60 Hz and higher frequencies. Direct and indirect EMF bioeffects are also discussed.

J.E. Deadman et al., "Occupational and Residential 60-Hz Electromagnetic Fields and High-Frequency Electric Transients: Exposure Assessment Using a New Dosimeter," *American Industrial Hygiene Association Journal*, 49, pp.409-419, August 1988.

Using the lightweight dosimeter developed by Hydro-Québec's IREQ (see *MWN*, S/O86), this team from McGill University and from Hydro-Québec measured significantly higher electric and magnetic field and high-frequency transient electric (HFTE) field exposures for utility workers than for those exposed to normal background fields—by a factor of ten for electric and magnetic fields and by a factor of 171 for HFTE fields. When weekly averages—combining work and non-work exposures—were compared, the differences were still significant, though smaller, for magnetic fields (a factor of 3.5) and for HFTE fields (a factor of 58).

William Feero, John Dunlap and James Yontz, "Magnetic Fields Remote from Substations," presented at the *Winter Meeting of the IEEE Power Engineering Society (PES)*, January 29–February 3, 1989 in New York City. A copy is available for \$3.50 (members) and \$6.50 (nonmembers) from: Single Publication Sales Dept., IEEE Service Center, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855. Cite

No.89WM096-9PWRD.

This study was prompted by public fears of health risks when Florida Power and Light Co. announced plans to build a new substation. The researchers found that the EMFs associated with substations decay quickly with distance—no fields could be detected 250 feet from the substation studied. Twenty feet from the fences of three similar 23 to 230 kV substations, the magnetic fields were less than 20 mG, often less than 10 mG, with the exception of transmission line entry and exit points.

Lita Furby et al., "Public Perceptions of Electric Power Transmission Lines," *Journal of Environmental Psychology*, 8, pp.19-43, 1988; and "Electric Power Transmission Lines, Property Values and Compensation," *Journal of Environmental Management*, 27, pp.69-83, 1988.

In the first article, the authors review and critique the literature on attitudes towards power lines, including such issues as health effects, property values and aesthetics. In the second, they concern themselves with current methods of determining the impact of power lines on land values and appropriate compensations to landowners for associated losses. The authors include Paul Slovic and Baruch Fischhoff, who are well-known for their studies on risk analysis.

N. Hayashi, K. Isaka and Y. Yokoi, "Analysis of Magnetic Field Profiles in Electric Blanket Users," presented at the *IEEE Power Engineering Society (PES) Winter Meeting*, January 29–February 3, 1989 in New York City. (See Feero et al. at left for ordering information; cite No.89WM100-9PWRD.)

Professor Isaka and coworkers at the University of Tokushima in Japan present calculations of magnetic fields from electric blankets, which agree reasonably well with measured values. Among their conclusions are that, "The separation between the body surface and

the blanket heating element is the most influential parameter on the magnetic field exposure," and that the maximum fields on the user's body surface range from 5 to 50 μ T, depending on which component is measured.

Jukka Juutilainen et al., *Measurements of 50 Hz Magnetic Fields in Finnish Homes*, Helsinki, Finland: Imatran Voima Oy, 31 pp., 1989.

Juutilainen and coworkers at the University of Kuopio report that ELF magnetic fields from T&D lines "can increase the long-term average field levels in residences," but they warn that the increase was "found only in the immediate vicinity of external sources." Magnetic fields from appliances were "slightly lower," though "of the same order of magnitude," as reported in U.S. surveys—perhaps due to the different distribution voltages. They also found that higher magnetic fields were measured in rooms with electric underfloor heating.

Daniel Lyle et al., "Suppression of T-Lymphocyte Cytotoxicity Following Exposure to 60-Hz Sinusoidal Electric Fields," *Bioelectromagnetics*, 9, pp.303-313, 1988.

Lyle and coworkers at Dr. Ross Adey's lab in Loma Linda, CA, found a significant inhibition of cytotoxicity in T-lymphocytes following exposure to 10 mV/cm and 1.0 mV/cm electric fields and a non-significant inhibition at 0.1 mV/cm. These findings indicate a dose-response relationship and a threshold for the effect, and also point to a potential mechanism by which electric fields affect the function of the immune system.

Carl Maresh et al., "Exercise Testing in the Evaluation of Human Responses to Powerline Frequency Fields," *Aviation, Space and Environmental Medicine*, 59, pp.1139-1145, December 1988.

Eleven men in their 20s exposed to 60 Hz (9 kV/m, 16 A/m) fields for two hours had slower heart rates if they did not exercise first—there was no difference between exposed and controls if the exposure followed 45 minutes of exercise. The researchers are at the University of Connecticut and at the Midwest Research Institute (MRI). They include MRI's Harvey Cohen and Dr. Charles Graham.

Granger Morgan et al., *Electric and Magnetic Fields from 60 Hertz Electric Power: What Do We Know About Possible Health Risks?* Pittsburgh, PA: Carnegie Mellon University (CMU), 45 pp., 1989. Copies are available (prepaid) for \$3.00 each for the first nine, \$2.00 each for ten or more, from: Dept. of Engineering and Public Policy, CMU, Pittsburgh, PA 15213.

This brochure, written by Morgan's research group at CMU, is designed for the layperson. Using a question and answer format, it includes what is and is not known about health effects, especially cancer, and concepts of risk assessment; there is also a glossary.

Keith Petrie et al., "Effect of Melatonin on Jet Lag After Long Haul Flights," *British Medical Journal*, 298, pp.705-707, March 18, 1989.

After flying back and forth through 12 time zones over a period of three weeks, a group taking melatonin reported being less tired

during the day and requiring less time to establish normal sleeping patterns than the control group. The researchers concluded that "melatonin can alleviate jet lag and tiredness after long haul flights."

Russel Reiter et al., "Reduction of the Nocturnal Rise in Pineal Melatonin Levels in Rats Exposed to 60-Hz Electric Fields in Utero and for 23 Days After Birth," *Life Sciences*, 42, pp.2203-2206, 1988.

Working with the Battelle team, Reiter found that rats exposed to electric fields of 10, 65 or 130 kV/m from conception to 23 days of age showed reduced peak nighttime pineal melatonin levels and shifts in circadian rhythms. No dose-response relationship was observed, however.

Martin Rosenthal and Günter Obe, "Effects of 50-Hertz Electromagnetic Fields on Proliferation and on Chromosomal Alterations in Human Peripheral Lymphocytes [HPLs] Untreated or Pretreated with Chemical Mutagens," *Mutation Research*, 210, pp.329-335, 1989.

Cultured HPLs exposed to 50 Hz 5 mT fields showed significant stimulation of the cell cycle progression, but no change in the frequency of sister-chromatid exchanges (SCEs) or chromosomal aberrations. In some cases, exposing HPLs pretreated with alkylating agents led to significantly higher frequencies of (SCEs). However, the authors reject the latter finding pending further studies.

O.C. Seevers, *Ground Currents and the Myth of Stray Voltage*, Lilburn, GA: The Fairmount Press, Inc., 211 pp., 1988, \$44.00.

The author, a utility engineer for nearly 40 years who has a chatty writing style, presents detailed electrical calculations as well as data from actual court cases involving stray voltage and ground currents. The publisher entices readers with the following incentive: "How understanding stray voltage can help you avoid costly lawsuits."

Mike Silva et al., "Power Frequency Magnetic Fields in the Home," *IEEE Transactions on Power Delivery*, 4, pp.465-478, January 1989.

Describes extensive measurements of residential magnetic fields from external and internal (e.g., appliances) sources. One interesting finding: certain two-way switch wiring configurations for overhead lighting—producing a large overhead coil—generated magnetic fields up to ten times the typical mean values. The work was supported by EPRI.

Richard Wurtman and Judith Wurtman, "Carbohydrates and Depression," *Scientific American*, 260, pp.68-75, January 1989.

The Wurtmans address mood and appetite disorders, including seasonal affective disorder (SAD) and, along the way, review the roles of serotonin and melatonin.

Xiao-lin Xi and Granger Morgan, "Energizing China: First Itself, Next the World," *IEEE Spectrum*, pp.59-63, March 1989.

An overview of the electric power industry in the People's Republic of China today.

BIOLOGICAL EFFECTS

MEASUREMENT

More Harm Than Good... Miniature radio transmitters which are strapped onto spotted owls to track their movements may be harming, rather than helping, the birds. According to a February 20 report by the Associated Press (AP), 37 out of 48 owls fitted with the transmitters, which weigh approximately 20 grams, died in the first year of study. Some experts contend that the spotted owls, which live in the north-west U.S., are an endangered species. Although one Fish and Wildlife Service biologist attributes the deaths to "predations and starvation," another points out that the devices have been shown to affect other birds, though there is no evidence of a similar effect on spotted owls, the AP reports. Both experts recommend further study.

COMPATIBILITY & INTERFERENCE

Assessing EEDs... Two staffers at the NIST (NBS) in Boulder, CO, have come up with a new method for characterizing the response of electro-explosive devices (EEDs) to pulsed EMFs: using a combination of statistics and thermodynamics to determine the probability that an EED will be detonated when excited by a pulse of a given width and amplitude. John Adams and Dennis Friday, whose study appeared in the November 1988 *IEEE Transactions on Electromagnetic Compatibility*, claim that their approach is both "more general and more efficient than previous methods used for EED assessment."

GOVERNMENT

Q's & A's on RF Bioeffects... The FCC has issued the third edition of *Questions and Answers about Biological Effects and Potential Hazards of RF Radiation*, OET Bulletin No. 56. The 18-page report provides answers to some basic questions, such as: What is RF radiation? How is it used? How is it measured? What are its biological effects? What are safe exposure levels? Also addressed are specific RF sources: TV and radio broadcast towers, MW point-to-point relays, cellular and cordless phones and satcom stations. The bulletin is available from: National Technical Information Service, Springfield, VA 22161, (800) 336-4700 for \$13.95. Order No. PB89-165286.

Committee Openings... The FDA is seeking nominations to fill five vacancies on its Technical Electronic Product Radiation Safety Standards Committee (TEPRSSC) at the end of 1989. The TEPRSSC addresses devices which emit either ionizing or non-ionizing radiation. The openings are for two members from the general public, two members from government (federal or state) agencies and one member from "affected industry." Applicants must have scientific or engineering training or equivalent experience. Send nominations to: Arlene Underdonk, Office of Standards and Regulations (HFZ-83), CDRH, 5600 Fishers Lane, Rockville, MD 20857.

Briefs... Robert Clarke gives some pointers on "Picking an EMI Test Lab" in the January 1989 issue of *Test & Measurement World*. He advises some caution: "Choose your EMI lab with the same care that you would use in choosing a doctor." The article includes a survey of the leading labs with a listing of the services offered by each.... The NIST (NBS) has signed an agreement with the Standards Council of Canada (SCC) that provides for mutual recognition of testing labs accredited by the NIST's NVLAP program and by the SCC's National Accreditation Program for Testing Organizations. The agreement is in accordance with the U.S.-Canada free trade pact, which went into effect on January 1, 1989. The pact with Canada follows similar arrangements with the U.K., Australia and New Zealand.... Holaday Industries has released a new 18-page catalogue of its RF/MW meters and its instruments that measure EMFs from VDTs and power lines. Contact: Holaday Industries, Inc., 14825 Martin Dr., Eden Prairie, MN 55344, (612) 934-4920.... Electro-Metrics has introduced a new portable hand-held EMI test receiver, the EMC-P80, for measurements in the 2-34 MHz band. The unit, which costs \$4,995, is ideal for tracking down radiated interference sources. The company is also now marketing a receiver for TEMPEST testing in the 20 Hz to 50 kHz frequency range. The TTR-51L costs \$19,950. Contact: Electro-Metrics Marketing Dept., 100 Church St., Amsterdam, NY 12010, (518) 843-2600.

New from the NIST... The NIST has issued two new reports. *Generation of Standard Electromagnetic Fields in a TEM Cell*, Technical Note 1319, by Dr. Motohisa Kanda and David Orr, details the pros and cons of the TEM—transverse electromagnetic—cell, which was developed at the NIST. It includes copies of some key papers on the use of TEM cells published over the last few years. A copy is available for \$12.00, prepaid, from: Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Order No. 003-003-02898-3.... NIST's Electromagnetic Technology Division has a prolific staff. Mary DeWeese has compiled *Metrolgy for Electromagnetic Technology: A Bibliography of NBS Publications*, NBSIR 88-3097, which lists its publications (1970-1988) on optical electronics, cryoelectronics and superconductivity. It is a companion to an earlier volume listing publications of NIST's Electromagnetic Fields Division (see *MWN*, J/A86). The new bibliography is available for \$15.95, prepaid, from: National Technical Information Service, Springfield, VA 22161. Order No. PB88-123682.

MEDICAL APPLICATIONS

AMA on PEMF Stimulation... A majority of a panel of experts assembled by the American Medical Association (AMA) has deemed that PEMF stimulation for the treatment of nonunion fractures is safe, but also that it has not yet been

UPDATES

shown to be effective. In a "Diagnostic and Therapeutic Technology Assessment" published in the February 10, 1989 issue of the *Journal of the American Medical Association*, the panel concluded that more well-controlled clinical trials are needed to establish efficacy: "Many [panelists] believed that the lack of controlled clinical trials compromised a thorough evaluation of the effectiveness of the treatment." Some promising results on a double-blind study of delayed fractures of the tibia may soon change this assessment. In a paper presented at the *101st Annual Meeting of the American Orthopaedic Association* in Hot Springs, VA, June 20-23, 1988, Dr. William Sharrard, based at Royal Hallamshire Hospital in Sheffield, U.K., reported a statistically significant enhanced union when treated with PEMFs. This finding is in contrast to preliminary results of a double-blind study—published in 1984 by Sharrard and others—indicating that nonunion fractures healed as well by immobilizing them as by treating them with PEMFs (see *MWN*, Ju84).

MEETINGS

Statisticians & EMFs...The *8th Conference on Radiation and Health of the American Statistical Association (ASA)*, July 9-13, will be devoted to "Health Effects of Electric and Magnetic Fields: Statistical Support for Research Strategies." Attendees at the meeting, which will take place in Copper Mountain, CO, will hear from Drs. Dan Bracken, a consultant, Leeka Kheifets of EPRI, Granger Morgan of Carnegie Mellon University, Charles Poole of Epidemiology Resources, Inc., Lee Rosen of W/L Associates, Mays Swicord of the FDA, Thomas Tenforde of Battelle and Gillis Theriault of McGill University, among others. For more information, contact: Marilyn Humm, ASA, 1429 Duke St., Alexandria, VA 22314, (703) 684-1221.

ELF and Power Line Sessions...More and more organizations are putting EMFs on their meeting agendas....The *35th Annual International Education Seminar of the International Right of Way Association*, June 18-22, will feature Harris Levin of Houston Light & Power on EMFs in the courtroom, as well as a question and answer panel on EMFs....At the *5th Annual Symposium of the Electromagnetic Energy Policy Alliance (EEPA)*, April 12-14, a panel of speakers from the EMF community will address the subject of "Electricity: Is There a Risk?" AT&T Bell Labs' Ron Petersen and Dr. Max Weiss will be the session co-chairmen. Also on the EEPA's agenda is a workshop on litigation, legislation and education, featuring Tom Watson of Crowell & Moring, who is involved in many power line cases around the country, and Gary Sazer of Parker, Chapin, Flattau & Klimpl, who is counsel to the Long Island Association, which is seeking to overturn New York's Suffolk County VDT law....At the *13th Annual Meeting of the American Society of Preventive Oncology*, March 20-21, Battelle's Dr. Richard Stevens will speak on electric power and breast cancer risk....And at the *51st Annual Meeting of the American Power Conference*, April 24-26, G.B. Johnson and

B.A. Clairmont, both of General Electric Co., who are at the EPRI High Voltage Transmission Research Center in Lenox, MA, will present a paper on "Measurements of AC and DC Field and Corona Effects in a Hybrid Corridor."

Zurich EMC Meeting...The *8th International Zurich Symposium and Technical Exhibition on EMC* was held March 7-9 in Switzerland. Among the 115 papers presented were a report from Japan on the global distribution of power line harmonic radiation based on satellite data, a report from The Netherlands on methods of protecting electronic equipment against EMI—including testing in high-voltage substations—and a report on a new F.R.G. procedure to establish safe distances between RF sources and electro-explosive devices. For more information, contact: Professor T. Dvorák, EMC Symposium & Exhibit, ETH-Zentrum - IKT, 8092 Zurich, Switzerland, (1) 256-2788.

MW Weapons...The *7th DOD Conference on Directed Energy Weapon Vulnerability, Survivability and Effects* will be held at the U.S. Naval Postgraduate School in Monterey, CA, May 9-12. Dr. T. Wieting of the Naval Research Lab will give an overview of high power microwaves (HPMs); Dr. H. Cabayan of Lawrence Livermore National Lab will discuss the susceptibility of U.S. systems to RF radiation; Howard Bassen of the Walter Reed Army Institute of Research will review the Army program on HPM bioeffects; and a team from Los Alamos National Lab will describe progress on explosion-driven HPM weapons research under the high-intensity single pulse source program. There will be additional presentations at the meeting, which is classified Secret. For more information, contact: Donna Richard, Booz, Allen & Hamilton, Inc., 1300 N. 17th St., Suite 1610, Rosslyn, VA 22209, (703) 527-5429.

MILITARY SYSTEMS

EIS on USAF Transmitter Site...The USAF has announced that it will prepare an environmental impact statement (EIS) for the planned Northeast Regional Communications Facility (NRCF) in the Pine Barrens near Warren Grove, NJ. The decision to prepare the EIS followed pressure from the NJ governor, NJ's Congressional delegation and the state legislature—all oppose building the 18 towers, which would range in height from 100 to 221 feet, in an environmentally sensitive area, according to the February 22 *Philadelphia Inquirer*. In 1985, the USAF also met intense opposition when it proposed building the NRCF in Hawley, MA (see *MWN*, J/A85); it later abandoned its plans for that site. For more information, contact: Richard DiCamillo, HQ USAF/PRPJB, Pentagon Room 5C966, Washington, DC 22030.

OVENS

More on Incomplete Cooking...Experts continue to warn consumers that food cooked in a MW may still harbor parasites and bacteria due to incomplete or uneven heating (see

MWN, Ju81, A82 and S/O88). Tests at the Institute of Food Research in Norwich, U.K., showed that a stuffed chicken treated with bacteria had viable bacteria after MW cooking. In order to prevent bacterial survival, the researchers recommend that food cooked (and reheated) in a MW reach a uniform temperature of 70°C. In a letter published in the January 28 *Lancet*, they advise letting food stand after cooking "to allow the heating to be evenly distributed by conduction without overcooking." ...In a related study appearing in the *Journal of Microwave Power and Electromagnetic Energy* (23, pp.183-194, 1988), Wen Lin and Dr. Carol Sawyer, both of the Department of Food Science and Human Nutrition at Michigan State University in East Lansing, report that wrapping meat loaf in polyvinylidene chloride film prior to MW cooking resulted in the survival of fewer anaerobic bacteria.

Consumers Union Ratings...In the March 1989 issue of *Consumer Reports*, Consumers Union (CU) evaluates over 50 midsize MW ovens for efficiency, price and MW radiation

leakage, among other criteria. According to CU, all of the ovens tested were "well within the U.S. Bureau of Radiological Health's [BRH] standard" for leakage (BRH is now known as the Center for Devices and Radiological Health). CU cautions, however, that any oven that has been damaged—from a fire, from a "serious overheating incident" or from having been dropped—may have a warped or misaligned door, which increases the likelihood of greater leakage. "If there's any doubt about the oven, have it checked by a qualified professional," the group advises. CU also notes the potential hazards associated with MW heat susceptors—metalized films and coatings used in packaging to concentrate heat for browning and crisping—and the FDA's concern that the high temperatures created by the susceptors might cause chemicals in the packaging to "contaminate" food. In addition, plastic wraps, when overheated, can leach chemicals into food. CU suggests that if you use plastic wraps for MW cooking, avoid their direct contact with food and poke holes in the plastic to release steam.

Florida Magnetic Field Standards (continued from p.1)

Tarpon-Kathleen line—are not giving up their fight for protective standards. The county attorney has issued a challenge to the rules, citing, among other issues, concern about potential health risks.

For magnetic fields, the maximum levels are 150 mG for lines of 230 kV or less and 200 mG for 500 kV lines; for certain double-circuit 500 kV lines, the limit is 250 mG (see table below). In contrast, in June 1988, the DER proposed *daily average* and *maximum* magnetic field levels of 50 mG and 100 mG, respectively. "We dropped the daily average standard, because it would be too hard to verify," Owen said.

For electric fields, the new standard is 2.0 kV/m at the edge of the right-of-way (ROW). The earlier proposed limit was 1.5 kV/m.

Under the new regulations, the 500 kV Lake Tarpon-Kathleen power line must comply with limits negotiated by

the state Siting Board and the Florida Power Corporation (FPC) during the line's certification process last spring: the magnetic field limits are a *daily maximum* of 35 mG and 24 mG under normal load conditions where the ROW is 100 feet and 190 feet, respectively. (Under load conditions exceeding 500 MW—allowed no more than 15 hours a year—the *maximum* levels are 229 mG at the 100-foot ROW and 154 mG at the 190-foot ROW.) Since the 500 kV line will only operate at 16% of its capacity, according to Owen, the limits are also based on a "technologically achievable" level.

In a March 22 petition, County Attorney Frederick Karl, representing Hillsborough County, argued that the rules "arbitrarily" separate power lines into three categories—existing lines, new lines and the Lake Tarpon-Kathleen line—and that they contain "substantive and material changes" from the way the rules were originally drafted. Furthermore, Karl charges

Florida's Standards for Maximum 60 Hz Electric and Magnetic Fields

Type of New Power Line

Type of Field	≤230 kV	500 kV	500 kV (double circuit)*	Proposed Levels†
Magnetic (edge of ROW)	150 mG	200 mG	250 mG	100 mG
Electric (edge of / on ROW)	2 / 8 kV/m	2 / 10 kV/m	2 / 10 kV/m	1.5 kV/m

* Special exceptions apply.

† The DER proposed these levels in June 1988. A daily average magnetic field limit of 50 mG was also proposed.

that the Environmental Regulation Commission "failed to consider all of the scientific evidence available" in promulgating the rules and that the rules "conflict with the Resolution passed the same day" which cites potential public health risks from power line EMFs (see box below). "Our position is that the standards are not protective of public health," Chief Assistant County Attorney Elliott Dunn told *Microwave News*. Dunn added that the county attorney's office became involved following an appeal from Hillsborough citizens to "keep up the fight" and challenge the rules.

The DER's decision to relax the proposed standards was prompted, in part, by data showing that seven out of ten 500 kV lines operating in the state can meet the 200 mG limit, Oven explained. Last year, Oven told *Microwave News* that the vast majority of the state's existing 500 kV lines did not conform to the proposed 50-100 mG levels, nor did more than half of the existing 230 kV lines (see *MWN*, M/J88). He pointed out that even some of the 138 kV lines could not comply.

The maximum magnetic field level for 230 kV lines, which was also raised to 200 mG, was later reduced to 150 mG

because of complaints from residents that a 200 mG standard would be too lax for smaller lines, Oven said. The 150 mG limit—which was proposed and then adopted at the January 18 hearing—is "basically a compromise" between what the utilities asked for and what the citizens wanted, he said.

For a history of the Florida rulemaking effort, see *MWN*, J/A83, J/A84, M/A86 and N/D87.

NAS-NRC on ELF Mechanisms (continued from p.1)

the epidemiological studies as "interesting, but inconclusive," and Dr. Roy Shore advised that, "We need stable results that can stand up to scrutiny."

A number of experiments "beg replication," Shore said. But he added that there are limits to how much can be derived from further epidemiological studies and that if he had a budget of \$10 million, he would spend it on good animal studies.

Like Heath, Setlow characterized the epidemiological literature as "interesting, but not convincing." With respect to the need for mechanisms, he said that, "If the data were stronger, there would be less need for mechanisms; when it is weaker, you look for mechanisms." Overall, he said that progress has been made in the field since the last academy meeting in 1985 (see *MWN*, N/D85 and M/J86). Setlow, the associate director of life sciences at the Brookhaven National Lab on New York's Long Island, has a background in both physics and biology.

Dr. David Carpenter, one of the invited speakers, argued that, from a public health point of view, "There is a certain urgency" for sponsoring a "serious and forceful investigation," even though "we are a long way from understanding mechanisms." He said that animal studies were needed to find out more about the risks of brain cancer and leukemia associated with ELF exposure.

Carpenter and Dr. David Savitz, who reviewed the epidemiological literature for the panel, both warned that if there is indeed a cancer risk, the available data would tend to underestimate it because of the poor dosimetry used in past studies.

A report will be prepared by the panel, according to Dr. Ray Cooper of the NAS-NRC's Board on Radiation Effects Research, who organized the workshop. Setlow predicted that the board will hold regular biennial briefings on non-ionizing radiation in the future.

Members of the NAS-NRC panel are: Drs. Richard Setlow, chairman, Brookhaven National Lab; Clark Heath, American Cancer Society; Robert Pound, Harvard University; Regina Santella, Columbia University; Herman Schwan, University of Pennsylvania (emeritus); Roy Shore, New York University Medical School; and Eugene Stanley, Boston University. The invited speakers were: Drs. Martin Blank, Columbia University; Craig Byus, University of California, Riverside; David Carpenter, New York State Department of Health; Russel Reiter, University of Texas, San Antonio; David Savitz, University of North Carolina, Chapel Hill; and Tom Tenforde, Battelle Pacific Northwest Labs.

Florida DER-ERC Resolution

1. WHEREAS, the Environmental Regulation Commission [ERC] of the State of Florida Department of Environmental Regulation [DER] on January 18, 1989, adopted standards and requirements to reasonably protect the public health and welfare from electric and magnetic fields generated by transmission lines; and

2. WHEREAS, the Commission based its decision on a thorough review of present scientific data on the potential health effects of electric and magnetic fields, wherein it found that although there is no conclusive evidence that there is any danger or hazard to public health at the levels of existing 60 Hz electric and magnetic fields found in Florida, there is evidence of a potential for adverse health effects on the public, with further research being needed to determine the extent of the effects and the exposure levels at which the effects occur; and

3. WHEREAS, the Commission further based its consideration on the recommendations of the Department's EMF Advisory Panel, which recommended, among other things, that it would be prudent to keep the long-term exposure of the population to low values, by so far as possible routing transmission lines outside of residential areas and, where this is not possible, to limit the magnetic and electric field strengths at the edge of the right of way.

NOW, THEREFORE, be it resolved:

1. The [ERC] encourages new electric transmission lines of 69 kV or greater to be sited in a manner that will consolidate such lines within existing corridors and that new corridors should be planned in coordination with land use plans of local governments in order to avoid placing corridors through residential areas.

2. This resolution shall be furnished to all local governments, Regional Planning Councils, and electric utilities in the state to assist their land use and siting plans.

RESOLVED before the [ERC] in Tampa, Hillsborough County, Florida, this 19th day of January, 1989.

Robert A. Mandell, Chairman

COMMENTARY

How Not To Revise the 1982 ANSI RF/MW Radiation Limits

This summer, the Bioelectromagnetics Society (BEMS) will present its highest honor, the D'Arsonval Award, to Dr. Ross Adey for his work on weak electromagnetic fields and their non-thermal effects. Although Adey won the support of the leaders of the society, not everyone is pleased. Dr. Eleanor Adair, for one, has resigned from the BEMS Awards Committee, charging that the decision will be an "embarrassment" to the society and that "his selection both demeans the award and denigrates the society." Many members of BEMS are astonished by Adair's charges.

Adair's work is on thermal physiology and she may have doubts about the existence of electromagnetic effects that have nothing to do with heating—she favored giving the award to Dr. Sol Michaelson, a loyal member of the thermalist school.

All this would only be a bad case of sour grapes if it did not raise serious questions about Adair's new role as co-chair, with Dr. Om Gandhi, of the subcommittee which is revising the 1982 American National Standards Institute (ANSI) limits for exposure to radiofrequency and microwave (RF/MW) radiation. In the absence of federal standards from the Environmental Protection Agency (EPA) or from the Occupational Safety and Health Administration, the ANSI limits have become the *de facto* U.S. standards and millions of Americans depend on them for protection at home and on the job.

The Adair-Gandhi subcommittee has now endorsed using a specific absorption rate (SAR) of 4 W/Kg as the threshold for ill effects in the revised standard—the same level as was used in 1982. In a February 2 letter to Dave Janes of the EPA, Adair wrote that she and Gandhi "agree that no further evaluation of the literature database is required to confirm the 4 W/Kg criterion."

The 4 W/Kg threshold was derived from studies by the U.S. Navy on behavioral disruption, according to Adair. On hearing this, EPA's Dr. Joe Elder responded that 4 W/Kg can kill an animal; he pointed out that SARs of 3.6 W/Kg are known to kill rats in a little over two hours. It is true that fur-bearing animals have different thermal regulatory systems than humans, but Elder also noted that rhesus monkeys experience "marked hyperthermia" at SARs of greater than 3.4 W/Kg and cannot tolerate SARs of more than 5.1 W/Kg for more than ninety minutes. He urged the subcommittee to "accept the dose rate of 4 W/Kg as the adverse effect level based on lethality in laboratory animals."

To be sure, ANSI builds in a safety factor—the 1982 exposure limits are based on an SAR of 0.4 W/Kg. But if 4 W/Kg can kill, what can the radiation do in more subtle ways and how much protection is warranted?

By retaining a 4 W/Kg limit, Adair and Gandhi appear to be disregarding a whole body of work that has appeared since

1982. The research is on both thermal and non-thermal effects and it indicates that 0.4 W/Kg is not protective.

In addition, there is no evidence that the subcommittee has ever discussed the potential RF/MW cancer risk—the subject of an ongoing EPA investigation.

With respect to thermal effects, EPA's Dr. Christopher Gordon has argued that when scaling from one species to another, differences in surface area are more important than differences in weight. According to Gordon's calculations, safety levels would have to be tightened by a factor of nearly ten to protect against the greater thermal insult.

When we reported Gordon's thesis two years ago, we quoted Elder as saying, "I expect there will be a lot of discussion of Gordon's paper in the bioelectromagnetics community" (see *MWN*, J/A87). This has not happened. That Adair has rejected Gordon's position is her prerogative, but she should nevertheless be encouraging a debate, not stifling one.

On the non-thermal front, the findings of Henry Kues of the Johns Hopkins University Applied Physics Lab and Jack Monahan of the Food and Drug Administration have serious implications: they have shown that pulsed microwaves can cause leakage in the blood-eye barrier of a monkey at an SAR as low as 2.6 W/Kg. When the eye is treated with glaucoma medicine the threshold is lowered to 0.26 W/Kg. How ANSI takes into account such synergy will be important to the more than two million Americans who use glaucoma drugs (see *MWN*, S/O86, J/A87 and J/A88).

The fact that the latest Kues-Monahan findings have not yet been published—the manuscript is in final editing—is immaterial. Both researchers are respected members of BEMS and they have presented a steady stream of results at the annual meetings. There is no doubt that the work is germane to health standards, so why is ANSI ignoring it?

Adair fears that giving the D'Arsonval Award to Adey will reflect badly on BEMS. This is nonsense. A much more important concern is how Adair's and Gandhi's actions on the ANSI standard will reflect on the bioelectromagnetics community if they fail to apply available knowledge to protect public and occupational health.

The "Commentary" column will be a regular feature in Microwave News. We invite our readers to write to us with their opinions.

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CONFERENCES

New Listings

May 9-12: **7th DOD Conference on Directed Energy Weapon Vulnerability, Survivability and Effects**, U.S. Naval Postgraduate School, Monterey, CA. Contact: Donna Richard, Booz, Allen & Hamilton, Inc., 1300 N. 17th St., Suite 1610, Rosslyn, VA 22209, (703) 527-5429 (see p.12).

May 16-18: **8th Annual Conference on Properties and Applications of Magnetic Materials**, McCormick Centre Hotel, Chicago, IL. Contact: Prof. Messinger, Dept. of Electrical and Computer Engineering, Illinois Institute of Technology, 3301 S. Dearborn St., Chicago, IL 60616.

May 25-27: **Interaction Mechanisms of Low-Level Electromagnetic Fields in Living Systems-Resonant Phenomena**, Stockholm, Sweden. Contact: Dr. Hans Lundberg, Royal Swedish Academy of Sciences, PO Box 50005, S-104 05, Stockholm, Sweden, (46) 8-150430.

June 21: **Annual Meeting of the Society for Light Treatment and Biological Rhythms**, National Institutes of Health, Bethesda, MD. Contact: Dr. Daniel Kripke, Veterans Administration Medical Center V116A, 3350 La Jolla Village Dr., San Diego, CA 92161, (619) 453-7500, ext. 3436.

July 9-13: **8th Conference on Radiation and Health of the American Statistical Association (ASA), Health Effects of Electric and Magnetic Fields: Statistical Support for Research Strategies**, Copper Mountain Conference Center, Copper Mountain, CO. Contact: Marilyn Humm, ASA, 1429 Duke St., Alexandria, VA 22314, (703) 684-1221 (see p.12).

September 20-22: **Symposium on Antenna Applications**, Allerton Park, Monticello, IL. Contact: Y.T. Lo, Dept. of Electrical and Computer Engineering, University of Illinois, 1406 W. Green St., Urbana, IL 61801, (217) 333-0293.

September 21-22: **39th Annual Fall Broadcast Symposium**, Hotel Washington, Washington, DC. Contact: Dr. Philip Rubin, Rubin, Bednarek Associates, 1667 K St., NW, Washington, DC 20006.

October 9-10: **21st Annual North American Power Symposium**, University of Missouri-Rolla, Rolla, MO. Contact: Dr. Charles Gross, Electrical Engineering Dept., Auburn University, Auburn, AL 36849, (205) 887-1812.

November 9-12: **11th Annual International Conference of the IEEE Engineering in Medicine and Biology Society**, Seattle, WA. Contact: Francis A. Spelman, Regional Primate Research Center SJ-50, University of Washington, Seattle, WA 98195, (206) 543-0440.

December 4-6: **International Conference on Magnetism and Magnetic Materials**, Rimini, Italy. Contact: Magis International S.r.l., Via Boccaccio, 19, 20123 Milan, Italy.

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

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

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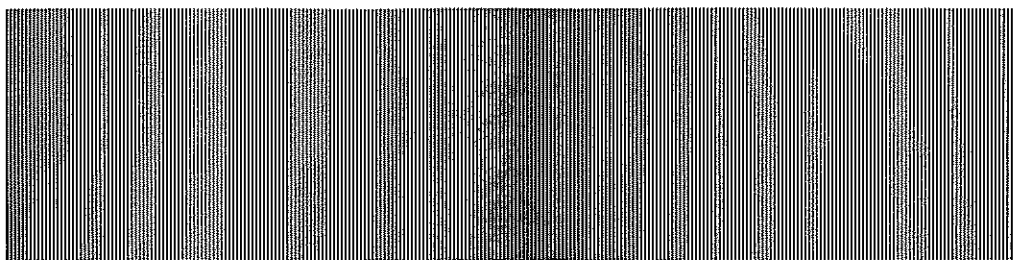
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MICRO WAVE NEWS



Vol. X No. 2

A Report on Non-Ionizing Radiation

March/April 1990

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New Listings

Are Brain Tumors Markers for EMF Exposure?

Two new epidemiological studies add to the growing evidence of a link between electromagnetic field (EMF) exposures and brain tumors. In one case, on-the-job EMF exposures were again identified as a risk factor for brain tumors and, in the other, occupational EMF exposures were associated with brain cancer among workers' children.

There are now at least 12 studies pointing to an EMF-brain tumor risk (see table on p.15). "There are far too many positive studies to dismiss an EMF-brain tumor connection," Dr. Samuel Milham, Jr., told *Microwave News*. "It is as important to have a number of studies showing a positive

RF/MW Radiation Stimulates Human Brain Tumor Cells

A new study shows that brain tumor cells continue to proliferate at an abnormally high rate five days after a two-hour RF/MW exposure. See p.5.

effect as it is to have one large study," he added. Milham was one of the first researchers to identify brain tumors as an EMF risk factor.

Much of the EMF-cancer research has focused on leukemia as the major risk, but some researchers believe that the brain tumor link is more persuasive. Dr. Nancy Wertheimer said, "I definitely feel the case has always been the most consistent for brain tumors. The focus on leukemia was not warranted by the data."

(continued on p.14)

New Research Funding Proposals Emerge at Congressional Hearing

Support is growing for a significantly larger federal power line research program. At a March 8 congressional hearing, two congressmen said that they will seek funding increases, and a utility spokesman proposed an industry-funded, government-run effort modeled on the New York Power Lines Project (NYPLP).

Rep. Peter Kostmayer (D-PA), who convened the hearing as chairman of the House Interior Subcommittee on General Oversight and Investigation, called for a "doubling or tripling" of the current federal power line electromagnetic field (EMF) research budget of \$3 million. "We are not talking about a lot of money when tens of millions of people may be protected as a result," he said. "The health impact of EMFs may very well be the most overlooked environmental hazard of the decade."

A second congressional proposal surfaced from Rep. Frank Pallone

(continued on p.7)

« Power Line Talk »

All those involved in the **Johns Hopkins University (JHU)** study showing higher cancer rates among NY telephone cable splicers say the work should be continued, yet the JHU team is less than confident that the necessary funding will be available. Following Drs. **Genevieve Matanoski** and **Patrick Breyse**'s announcement at last November's DOE-EPRI review (see *MWN*, N/D89), a peer advisory committee, assembled by EPRI to review the JHU team's original national case-control study, commented on the limitations of the NY incidence study as well. Breyse told us that the committee had concerns that an expansion of the study—even a doubling—would not yield meaningful results because the number of cases would still be too small. The committee—Drs. **Patricia Buffler**, **Philip Cole** and **Carl Shy**—encouraged the JHU team to develop a full research protocol and to seek funding, according to Buffler, who told us that, "We thought it was important that the questions be resolved." EPRI's Dr. **Leonard Sagan** appears to want to settle those issues as well. In the January/February issue of the *EPRI Journal*, he said that, "From the information we have seen...this clearly deserves to be followed up. EPRI intends to pursue possibilities for further research in this area with Dr. Matanoski to clarify the apparent differences in results." Although EPRI asked the JHU team to submit a funding proposal (EPRI did not pay for the NY study), Breyse said that EPRI does not appear to be too "enthusiastic." For the time being, the JHU team is finishing the case-control study before returning to the NY linemen project. "We're committed to expanding the incidence study. Our challenge will be to address the valid criticism of 'small numbers'," he said. The team is also looking around for other funding sources.

«« »»

The earth moved on February 28 when *New Yorker* writer **Paul Brodeur** and EPRI's Dr. **Leonard Sagan** went head-to-head in Santa Barbara before the California Municipal Utilities Association—in the middle of Brodeur's remarks, there was an earthquake (5.5 on the Richter scale). "I didn't realize EPRI was so powerful," Brodeur quipped. One observer, **Cyrus Noë**, the editor of *Clearing Up, Northwest Energy Markets*, summed up the debate this way: "Brodeur was appearing before a municipal utility audience that was not particularly sympathetic to his point of view, but despite that home-floor handicap, he beat Dr. Sagan 15 ways from Sunday. Brodeur had passion and outrage, Sagan had colored slides." The EMF issue is hot in Santa Barbara because of an unexplained childhood cancer cluster at the Montecito Union School. Between 1981 and 1988, there were six cases of leukemia and lymphoma among the students—five times the expected rate. Of particular concern is the fact that two 66 kV

power lines are on the perimeter of the school property. In addition, there is an electrical substation close by. The day after the Brodeur-Sagan face-off, **Jack Sahl** of Southern California Edison told the *Santa Barbara News-Press* that, based on his EMF survey, "Montecito looks like just a normal school in terms of [EMFs]." On March 16, the *News-Press* reported that the school board had decided to rope off sections of the school that have strong magnetic fields.

«« »»

Brodeur and Sagan would have faced each other again on *Nightline*—if the producers of the ABC-TV News late night show had had their way. An ABC spokeswoman told us that Sagan refused to appear because Brodeur was also scheduled to be interviewed. The *Nightline* show was to air on March 8, the day of the congressional hearing, but had to be delayed until the following night. *Nightline* host **Ted Koppel** interviewed Carnegie Mellon University's Dr. **Granger Morgan** and the New York Power Authority's **James Cunningham**, as well as Brodeur. A transcript is available for \$3.00, prepaid, from: Journal Graphics, Inc., 267 Broadway, New York, NY 10007. Credit card orders: (212) 227-7323. Specify Program #2295.

«« »»

Dr. **Jerry Phillips**, whose previous work has demonstrated that 60 Hz EMFs alter growth and membrane properties of human cancer cells, is leaving San Antonio, TX. Formerly with the Cancer Therapy and Research Center, he is joining the research group at the VA Medical Center in Loma Linda, CA, headed by Dr. **Ross Adey**. He and his wife, Dr. **Wendy Haggren**, will be studying the effects of 60 Hz magnetic fields on gene transcription.

«« »»

The widely-read *Harvard Medical School Health Letter* took a flippant look at EMF risks in its March issue. The newsletter asked the question, "How real a hazard?" and answered that, "It's impossible to say...." Then it offered the following Rx: "In the meantime, the very cautious may wish to unpack grandma's quilt, turn off the television and curl up with a good novel or seed catalog—or better yet, go out and cultivate the garden." The Harvard analysis appears to have been based on two interviews—with Drs. **Tom Tenforde** and **David Carpenter**. Dr. **Edward Wolpaw**, a member of the NY Power Lines Project scientific advisory group, is a member of the Harvard letter's advisory board.

Plans for NYPLP-II Continue

The New York State Department of Health (DOH) and the New York Public Service Commission (PSC) are moving forward towards setting up a new research effort on electromagnetic field (EMF) health effects. The PSC is seeking up to \$10 million for the proposed second New York Power Lines Project (NYPLP-II), which would follow up on the findings and recommendations of the original panel report (see *MWN*, J/A87 and N/D88).

"It is important that we reach some definite conclusion on what the hazard is," DOH's Dr. David Carpenter told *Microwave News*. The state cannot conclude that there is a real likelihood of a health risk and then leave it hanging, he said. Carpenter headed the first NYPLP, which sponsored the Savitz epidemiological study as well as a number of other key studies.

Like the original project, NYPLP-II would be directed by an independent panel of experts who would select the research studies to be funded. It would run for five years and would most likely be supported by a consortium of state utilities.

The PSC's Dr. Dan Driscoll has been meeting with state utilities to discuss their funding NYPLP-II. "Everything is still in the planning stage," he said in an interview, adding that he hopes to have something definite "within the next few months." Driscoll noted that the New York Power Authority's March 8 proposal for a \$15-20 million national EMF research program "will certainly have an influence on the next round of discussions" (see p.1).

Driscoll estimated the cost of the project at \$3-10 million, depending on whether the PSC can convince other state commissions, as well as national groups, to participate in a joint EMF research effort—organizations in other countries are also being approached. The project would be limited to \$3 mil-

lion if support comes only from NY utilities, he said.

On December 19, the PSC hosted a workshop on ongoing and future EMF research and the adequacy of its response to the NYPLP panel's recommendations. Five of the original panel members attended. Driscoll said that many of the participants felt that it was "important to do more basic research," particularly on melatonin production, circadian rhythms, gene expression and calcium efflux—areas which have shown "robust effects." The participants also called for further investigation into effects on learning, reaction time and behavior, as well as on neurobiology.

Power Line Controversy Heats Up in the U.K.

Allegations that government officials are failing to protect the public and workers from power line and other types of electromagnetic fields (EMFs) are being raised in the U.K. The charges were made in the February issue of *Electronics World + Wireless World (EW+WW)*, a monthly trade magazine, which devoted extensive coverage to what it called the "Killing Fields."

In an editorial in its March issue, the magazine took the state-owned Central Electricity Generating Board (CEGB) to task for refusing to release the results of an epidemiological study. Dr. Robin Cox, chief medical officer for the CEGB, denied the allegations and said that the results will be submitted for publication, but *EW+WW* rejected his explanation and argued that Cox is hiding the information. "It seems logical to look for other motives," Editor Frank Ogden wrote.

Ogden suggested that, "Publication would...interfere with the forthcoming privatization [of CEGB] scheduled for the end of the year" (see *MWN*, M/A88). If CEGB's preliminary findings support a link between EMFs and cancer, Ogden noted, there will be public calls for compensation and mitigation.

The contributors to the "Killing Fields" special issue were: Alasdair Philips of Electronics and Computing for Peace; Simon Best, a coauthor of the 1989 book, *Electromagnetic Man*; and Roger Coghill, a private consultant who has claimed an association between sudden infant death syndrome (SIDS) and EMF exposure (see *MWN*, M/A89).

Philips questioned the safety of the National Radiological Protection Board's (NRPB) extremely low frequency (ELF) exposure guideline of 2 mT (20 G or 20,000 mG). He charged that, in its references, the NRPB had "deliberately excluded" most of the reports showing possible dangers from low-level, non-thermal EMFs. Indeed, the literature review promised in 1988 has still not been published.

The special report coincided with an editorial in the February 1990 issue of the *Journal of the Royal Society of Medicine* by CEGB's Cox, who concluded, on the basis of completed research, that "fields from power frequency systems do not have any significant health effects for the general public."

NY Proposes 200 mG Limit

The New York Public Service Commission (PSC) has proposed an interim magnetic field limit of 200 mG for new transmission line right-of-ways (ROWs). The announcement came on March 28, as *Microwave News* went to press.

The limit is twice as lenient as the 100 mG recommendation made by a PSC task force in 1988. Dr. Dan Driscoll, who chairs the task force, told *Microwave News* that the 200 mG limit was determined on the basis of technical design considerations—not health concerns.

To obtain a copy of the proposed standard, contact: John J. Kelliher, Secretary, New York PSC, 3 Empire State Plaza, Albany, NY 12223, (518) 474-2500. For more on development of the standard, see *MWN*, M/A88 and M/J88.

The editorial sharply criticized epidemiological studies of residential ELF exposures by Dr. Nancy Wertheimer and Ed Leeper and by Dr. David Savitz. "An objective assessment of the epidemiological evidence must...lead one to the conclusion that it is weak and unconvincing," Cox wrote. He argued that the public has been swayed by "quasi-scientific work."

Cox noted, however, that confirmation of Savitz's findings would suggest "a significant public health problem because of the ubiquity of the fields" at the 2 mG level found by Savitz to be associated with an increased risk of childhood cancer.

At the NRPB, Assistant Director J.A. Dennis has taken a more moderate position. In a letter that appeared in the April issue of *EW+WW*, Dennis stated that there is "a growing literature" associating EMF exposures and cancer. Responding to charges that the NRPB had discounted the epidemiological data without cause, Dennis cited inconsistencies in the data. "Given the uncertainty about the reality of the risk and the considerable uncertainties in its quantification, it would be premature to specify limits based on the possibilities for long-term effects on health," he wrote. "Nevertheless, there is obviously a case for avoiding unnecessary exposures and reducing exposure levels where this can be done easily." He also advocated further research.

The stirring within the U.K. electronics community is having an impact in the U.S. An editorial in the March 15 issue

Censorship at the BBC

The British Broadcasting Corp. (BBC) was pressured into dropping an interview with the CEEB's Dr. Robin Cox, in which he refused to give assurances that there were no health risks associated with living next to power lines, according to a report by Tim Kelsey in the April 1 issue of *The Independent on Sunday*, published in London.

Cox was interviewed for a segment aired on the March 22 edition of the BBC television show, *Nature*. At the last minute, a second interview with Cox was substituted over the objections of the BBC producers.

The National Grid Co., which owns and operates the power lines in the U.K., asked the BBC to delete the first interview, because, as a spokesman for the National Grid told the *Independent*, Cox "had been ambushed" and the company was seeking to protect Cox's reputation—not to save the industry from embarrassment.

of *Electronics Design News* summarized *EW+WW*'s major findings and joined the call for more research. "Clearly, it's time to carefully examine our standards for exposure to electromagnetic radiation in the [ELF] portion of the spectrum," the editorial stated.

New from EPRI

The following publications from the Electric Power Research Institute (EPRI) range in subject matter from power line (AC and DC) bioeffects to electromagnetic interference (EMI). Copies (except for the *EPRI Journal* and the Delavan proceedings) are available, prepaid, from: Research Reports Center, PO Box 50490, Palo Alto, CA 94303, (415) 965-4081.

- "Pursuing the Science of EMF," *EPRI Journal*, January/February 1990. In a cover story on EMFs, EPRI reviews its growing research efforts, with an emphasis on laboratory, exposure assessment and epidemiological studies. The 14-page article includes a special section on the Matanoski telephone linemen studies (see *MWN*, N/D89 and p.2) For more information, contact: Editor-in-Chief, *EPRI Journal*, PO Box 10412, Palo Alto, CA 94303.

- *Extremely Low Frequency Electric and Magnetic Fields and Cancer: A Literature Review*, EN-6674, \$32.50, December 1989. This report is a revision of a background paper prepared for EPRI's July 1988 workshop on EMFs and cancer research held in Carmel, CA. It is supplemented by abstracts of the papers presented at the workshop. Among the topics covered are epidemiological and laboratory studies, as well as dosimetric and engineering factors. The review was prepared

by Drs. Robert Goldberg and William Creasey of Information Ventures, Inc. in Philadelphia, PA, the firm that used to publish the BENER reports. An electronic version of this data base will be available soon.

- *Pilot Study of Residential Power Frequency Magnetic Fields*, EL-6509, Final Report, \$40.00, September 1989. Luciano Zaffanella of General Electric found that the largest contributors to residential magnetic fields are transmission and distribution lines, grounding system currents and unusual wiring configurations. He concluded that magnetic fields from distribution line net currents and residential grounding system currents "could not be predicted solely by visual inspection of distribution line characteristics" and that "despite a correlation between [Wertheimer-Leeper] wiring code and magnetic field, the code would misclassify a large portion of residences...." These observations were based on measurements at 53 residences. EPRI is expanding the study to include 1,000 homes around the country.

- *Identification of Ions Near HVDC Transmission Lines*, EN-6391, Final Report, \$25.00, May 1989. F.L. Eisele of the Georgia Institute of Technology in Atlanta offers evidence that the types of ions generated near high-voltage DC (HVDC) transmission lines are chemically similar to those found in the natural environment. His results suggest that the

lifetimes of both positive and negative ions are important determinants of the ion spectra found near HVDC lines.

• **Current Studies of Possible Health Effects of Exposure to Power Frequency Electric and Magnetic Fields**, EN.3009.11.89R, \$200.00 (free to members), November 1989. This 30-piece slide show on EMFs, which includes a script for speakers, describes EPRI's current research program. Also available free of charge (\$20.00 for each additional copy) are two related publications, *Electric and Magnetic Fields: Human Health Studies*, EN.3010.11.89, November 1989; and *Electric and Magnetic Field Fundamentals*, EN.3012.9.89, September 1989.

• **Mutual Design: Overhead Transmission Lines and Railroad Facilities; Susceptibility Program**, EL-6462-M, Final Report, \$32.50, July 1989. This is the latest report on possible EMI from power lines to railroad signaling systems (see also *MWN*, S83 and Mr84). A team led by M.J. Frazier of the Science Applications International Corp. in Hoffman Estates, IL, developed a method of quantifying the EMI threat with a laboratory track simulator. The lab test "agreed very closely with

field results, verifying the accuracy of the simulator." The Association of American Railroads cosponsored the study with EPRI.

• **EMDEX System Manuals, Volume 1: User's Manual and Volume 2: Technical Reference Manual**, EN-6518, Interim Reports, \$25.00 and \$32.50, respectively, October 1989. Volume 1 provides instructions for using the EMDEX measurement system, an ELF dosimeter; Volume 2 presents detailed descriptions of the hardware and software. The reports were prepared by Enertech Consultants in Campbell, CA.

• **Proceedings of the EPRI Utility Seminar on Power Frequency Electric and Magnetic Field: Laboratory Research**, held September 27-29, 1989, in Delavan, WI. Among the topics addressed were cancer and cell physiology—as well as health risk research in general. Copies are available for \$50.00 (EPRI members, public agencies, nonprofits and universities) or \$250.00 (all others) from: Robert S. Banks Associates, Inc., 825 Washington Ave., SE, Suite 104, Minneapolis, MN 55414, (612) 623-4646. Note: Only a limited number of copies are available.

HIGHLIGHTS

RF/MW Stimulates & Suppresses Human Brain Tumor Cells

Five days after a two-hour exposure to radiofrequency and microwave (RF/MW) radiation, human brain tumor cells continued to proliferate at an abnormally high rate. At higher levels, however, the radiation suppressed cell growth. Drs. Stephen Cleary, Li-Ming Liu and Randall Merchant of Virginia Commonwealth University in Richmond observed similar results one and three days following exposure.

The researchers found highly statistically significant enhancement at specific absorption rates (SARs) of 5 or 25 W/Kg. At higher SARs, cell growth was suppressed. Essentially the same effects were obtained for exposures to unmodulated 27 MHz and 2450 MHz radiation.

In a paper published in the January 1990 issue of *Radiation Research* (121, pp.38-45), Cleary and coworkers report that RF/MW radiation had pronounced effects on the DNA and RNA synthesis of glioma cells, as measured by the incorporation of thymidine and uridine—genetic building blocks.

The cells were kept at a constant temperature during exposure, allowing the authors to conclude that the "effects were not induced indirectly by heating."

In a second paper, scheduled to appear later this year in *Bioelectromagnetics*, the team will report parallel effects when lymphocytes—white blood cells—were exposed under the same conditions. These cells were untransformed.

These results have important implications: on the one hand, RF/MW radiation may promote cancer and, on the other

hand, the radiation could be harnessed to treat malignancies. "If you stimulate transformed cells, you can enhance their potential growth," Cleary told *Microwave News*. "But on the upside, if you can retard them, there is a potential for great benefit." For example, Cleary envisions the day when blood cells may be circulated out of the body, as in dialysis, and exposed to RF/MW radiation to suppress proliferation of cancer cells.

In the paper, the researchers say that their findings are "significant since [they] suggest the possibility of cumulative effects of RF radiation when exposure occurs at intervals on the order of five days or less." The combined findings suggest a "general cellular response" to RF/MW radiation. The team hypothesizes that the effects may be explained by a shifting of cell cycles.

The results pose many questions. For instance: Are there effects at SARs below 5 W/Kg? Does the stimulation continue beyond five days after exposure? What are the effects of multiple, intermittent exposures? Would different effects be observed *in vivo* where heat would not be dissipated as effectively as *in vitro*?

Cleary is having difficulty securing funds for further research. "It's very frustrating," he said. "Without a new grant, we will be unable to investigate the effects of cumulative and multiple exposures or to determine mechanisms."

New World Health Organization Report on NIER

The World Health Organization's (WHO) Regional Office for Europe has published a second edition of its report on *Non-Ionizing Radiation Protection*. The 346-page volume covers the spectrum from extremely low frequency (ELF) fields to ultraviolet radiation, and includes a section on regulation and enforcement.

Since the first report was issued in 1982 (see *MWN*, My83), "...much new research has been performed and experience gained in NIER protection, especially in the areas of radiofrequency [RF] radiation and electric and magnetic fields [EMFs]," according to the WHO.

In the chapter on RF radiation effects, Drs. P.A. Czerski, Joe Elder, Kjell Hansson Mild, Asher Sheppard and Maria Stuchly conclude that limiting occupational and general population exposures by "voluntary or mandatory standards is desirable," and note that the IRPA RF exposure guidelines reflect the "emerging international consensus." They recommend that future research look at frequencies below 10 MHz, "where few data exist."

Drs. Larry Anderson and William Kaune, who prepared the chapter on ELF fields, conclude that current research suggests that EMFs are "environmental agents of relatively low potential hazard to biological systems," and that, "Human data from epidemiological studies, including reported effects on cancer promotion, congenital malformations, reproductive performance and general health, though somewhat suggestive of adverse health effects, are not conclusive."

Non-Ionizing Radiation Protection, Second Edition, (WHO Regional Publications, European Series No.25, 1989; Order No.1310025), edited by Michael Suess and Deirdre Benwell-Morison, is available for \$34.40 from: WHO Publications Center USA, 49 Sheridan Ave., Albany, NY 12210; or for 43 Sw. Fr. from: WHO Distribution and Sales, 1211 Geneva 27, Switzerland.

Electronic Devices-Avionics EMI Report Available

The Radio Technical Commission for Aeronautics (RTCA) has released its report on electromagnetic interference (EMI) to aircraft communications and navigation systems from portable electronic devices. The RTCA recommends that the use of all such devices be prohibited during takeoffs and landings.

Overall, the RTCA concludes that the risk of interference is "small" but recommends that the Federal Aviation Administration develop rules which "specify the conditions under which portable electronic devices may be operated on an aircraft." The RTCA also recommends that the Federal Commu-

New Microwave Meters from Narda and Holaday

The two leading microwave (MW) meter manufacturers have introduced new monitoring devices.

Constant Surveillance Monitor

Loral Microwave-Narda is marketing a meter called SMARTS that sounds an alarm and flashes lights whenever field levels exceed 1 mW/cm². The device is the first of its kind, making it possible to warn of possible over-exposure at all times. Previously, high field levels could be detected only while measurements were being taken with a hand-held meter. The monitor operates at 2 to 18 GHz.

The model 8820 SMARTS (Surface Mounted Automatic Radiation Threshold Sensor) is similar in concept to a household smoke detector and is designed for sites where exposure is a constant concern, such as areas next to high-power MW systems and satellite uplink stations.

The model 8820 SMARTS is available for \$2,500.00 in the U.S. from: Loral Microwave-Narda, 435 Moreland Rd., Hauppauge, NY 11788, (516) 231-1700.

Low-Cost Oven Meter

Holaday Industries is selling a new inexpensive microwave oven meter. The model HI-1801 is calibrated from 0 to 10 mW/cm². A "check" function responds to very low leakage levels to assure that the meter is working.

Model HI-1801 is available at the introductory price of \$289.00 (for a limited time) from: Holaday Industries, Inc., 14825 Martin Dr., Eden Prairie, MN 55344, (612) 934-4920.

nications Commission create a new class of carry-on devices and set frequency and amplitude limits for their radiation emissions.

The RTCA report was essentially completed in late 1988 and its findings were made available to *Microwave News* at that time (see *MWN*, N/D88).

The two-volume report, *Potential Interference to Aircraft Electronic Equipment From Devices Carried Aboard* (RTCA/DO-199), was prepared by Special Committee 156, chaired by Frank White. Volume I contains the findings and recommendations, as well as data collection and analysis. Volume II includes supporting reference materials. Both are available from: RTCA, One McPherson Square, 1425 K St., NW, Suite 500, Washington, DC 20005, (202) 682-0266. The cost is \$32.00 per volume in the U.S., Canada and Mexico (\$40.00 elsewhere), plus \$4.00 shipping and handling (\$8.00 elsewhere). Prepayment is required.

(D-NJ), who announced that he will introduce legislation to increase federal research and public information.

Almost all of the hearing witnesses backed a significantly larger federal power line research program; the only opposition came from the Department of Energy (DOE) and the Environmental Protection Agency (EPA)—ironically, the two agencies historically most involved in EMF research.

Kostmayer appeared visibly frustrated by DOE and EPA officials. Both agencies "are resistant to recognizing the potential seriousness of the problem we're facing," he said in an interview with *Microwave News*. DOE is "indifferent, almost cavalier," he added.

Robert San Martin, a deputy assistant secretary of energy, described the department's EMF research as "rational and reasonably satisfactory at this time."

EPA's Richard Guimond, head of the Office of Radiation Programs, testified that, "We don't advocate modifying our role at this time." Guimond said that EPA currently is completing a cancer assessment on EMFs and is preparing a handbook on EMFs similar to EPA's widely distributed radon handbook.

The hearing attracted an overflow audience but only one subcommittee member other than Kostmayer.

Industry Initiative

James Cunningham, a senior vice president at the New York Power Authority (NYPA) who appeared on behalf of the Large Public Power Council (LPPC), proposed that the electric utility industry voluntarily provide \$15-20 million for a federally supervised research program. The proposal seemed to surprise other industry officials, who opposed it.

Dr. Leonard Sagan of the Electric Power Research Institute (EPRI) called instead for more federal funding. "The federal government has failed in its responsibility," Sagan charged. It should "engage in a far greater research program than formerly." In contrast to most other witnesses, Sagan characterized EMF risks as "entirely hypothetical and uncertain." He cautioned, however, that confirmation of health effects would involve "potentially great costs to the nation."

Kostmayer told *Microwave News* that he would consider introducing legislation to provide tax credits or other incentives to encourage utilities to contribute. If LPPC's proposal is not viable, he will support legislation to increase federal funding. "If we can get the industry to pay, that's great," he said. "If not, we're going to have to find the federal funds."

Dr. Granger Morgan, of Carnegie Mellon University and a coauthor of the 1989 Office of Technology Assessment (OTA) report recommending "prudent avoidance" (see *MWN*, J/A89), also identified a "strong need for a stronger and more consistent federal role." Morgan warned that, "If there are health consequences, there will not be time to learn how to respond." Morgan specifically cautioned that the power line issue may be "driven" by liability. "Spending the next 10-15 years litigating is not in anybody's best interest," he said.

Prudent Avoidance?

Prudent avoidance means different things to different people. Rep. Peter Kostmayer asked several witnesses whether they have changed their lifestyles out of concern about EMF exposures. Here's what they said:

Carnegie-Mellon's Dr. Granger Morgan reported that he had moved his son's bed across the room away from the household electricity point of entry, gotten rid of his electric blankets and moved clocks away from beds. Chris Dodge of the Library of Congress took less extensive measures, putting away his electric blanket "except during the last cold snap." OTA's Karen Larsen has not yet been sufficiently concerned. "One of these days I'll get measurements," she reported.

In response to the perennial question, "Given the option between buying a house along a transmission line right-of-way (ROW) and buying an identical house at the same price at another location further from the ROW, which would you buy?" Morgan said he would choose to live further from the line. He first protested that there are numerous risk factors that might influence his decision but then conceded that, "If it's a cost-free choice, obviously I'd live in the house that doesn't have an external source."

Diane Allen, the TV reporter, said that she had her utility bury the main entry line to her house. Philadelphia Electric (PE) had found "very high" magnetic field levels at the point of entry, she said. Subsequent readings found fields just 10% of what they had been. In addition, Allen threw away her electric blanket and moved the clock radios from her children's bedstands.

PE's Charles Boeggeman was the only utility official asked about residential EMF levels. He said that his company has responded to more than 100 requests for measurements over the past three years. There is no set protocol and the readings are "not exhaustive," he explained. Boeggeman said that if a field of 30 mG is found in a location, for example, "we may tell the resident to consider moving the baby's crib."

In testimony submitted after the hearing, the Electromagnetic Energy Policy Alliance, a trade association, called prudent avoidance "illogical and inappropriate" and opposed it altogether.

DOE, EPA Programs Critiqued

Dr. David Carpenter, who supervised the NYPLP, sharply criticized federal efforts in general and DOE's program in particular, calling it a "disaster." "The fault lies with the federal government, that they have not taken the lead," Carpenter testified. There is a need for more money and better management, he added.

Carpenter told the subcommittee that DOE does not use a legitimate peer-review process in awarding grants, and charged that "higher ups" at the department want it that way. When he served on a DOE review panel, he said, the panel held just one business meeting, at which just one proposal was reviewed and rejected. In contrast, DOE hosted three cocktail parties for the panelists, he said.

Carpenter also criticized EPA's "very poor" track record, but added that he has "high regard" for many EPA staffers. He advocated concentrating power line research at the National Institutes of Health, despite a recent controversy at the National Cancer Institute over officials who provided paid testimony on behalf of utilities involved in legal challenges to transmission line sitings.

Credibility Questions

The objectivity of EPRI-supported research was a theme that dominated the hearing, since EPRI now spends twice as much each year as the government. "Public concerns over the credibility of health research funded by electric utilities that have an interest in the final outcome are not easily dismissed," Kostmayer said. Cunningham countered by arguing that although he recognizes "there is a perception of bias...we deny this bias." Sagan was more direct in defending EPRI research: "The industry deserves credit rather than criticism."

Most of the testimony echoed Kostmayer's concern, however. TV reporter Diane Allen, who aired a five-part news series on power line EMFs last fall, told the subcommittee that EPRI-supported scientists "were the least forthcoming and the most vague about their research." Allen told of one unidentified scientist who was "reluctant" to discuss possible EMF health hazards on-camera but who told her off-camera, "I sure wouldn't sleep under an electric blanket." Sagan expressed surprise about this incident and said that he had "never before heard that investigators are constrained."

Others also expressed doubts about relying primarily on utility-sponsored research. Karen Larsen, senior analyst for the OTA study, testified that she is aware of some concern among EPRI-funded researchers "that positive findings may mean that funding won't be renewed."

Carpenter raised questions about members of EPRI's advisory panels, who he said are "paid rather well." EPRI has "logically chosen individuals with certain philosophies," he told the subcommittee. "Any time money changes hands it has the potential to influence one's opinions."

Sagan reacted angrily to the charges. "Everybody pays their consultants," he said. "I think [EPRI] is objective." Morgan, who is heading a large risk study for EPRI, also defended its research program. "One should not fault this industry for taking initiatives," he said.

Kostmayer asked several experts to respond to Sagan's statement that EMF risks "remain entirely hypothetical and uncertain." Morgan, Dodge and Carpenter all disagreed with Sagan.

ROW Limits Proposed

Rep. Frank Pallone (D-NJ) plans to sponsor a second piece of legislation, which would set a field strength standard at an as-yet-undetermined level along transmission line right-of-ways (ROWs) for new lines.

Dr. Robert Becker, the author of *Cross Currents*, supported the ROW limit concept. In prepared testimony, Becker stated that there are sufficient data to set a "permissible dose rate." Basing his recommendation on studies showing an association between cancer occurrence and EMF exposure at levels above 3 mG, Becker called for a maximum acceptable level of 1 mG in all dwellings, schools and public buildings near transmission lines, substations and distribution lines. He also recommended that that limit be time-averaged for utility workers to an integrated dose of 8 mG per day.

Pallone attributed his involvement to constituents in and around Middletown, NJ (in his district), who have been opposing construction of a 234 kV transmission line along an electric railroad ROW (see *MWN*, J/A89).

Invited Witnesses

(in alphabetical order)

Diane Allen, Anchor-Reporter, WCAU-TV, Philadelphia, PA; Dr. Robert Becker, Author of *The Body Electric* (1985) and *Cross Currents* (1990), testimony submitted; Charles Boeggeman, Electrical Engineer, Philadelphia Electric Company; Dr. David Carpenter, Dean, School of Public Health, State University of New York, Albany; James Cunningham, Senior Vice President, New York Power Authority, testifying on behalf of the Large Public Power Council (LPPC); John Deason, Office of Environmental Affairs, Department of the Interior (DOI); Frank De Vito, Township Committee Member, Middletown, NJ; Christopher Dodge, Congressional Research Service; Richard Gulmond, Director, Office of Radiation Programs, Environmental Protection Agency (EPA); Karen Larsen, Senior Analyst, Office of Technology Assessment (OTA); Jack Lee, Jr., Environmental Health Specialist, Borneville Power Authority (BPA); Dr. M. Granger Morgan, Department of Engineering and Public Policy, Carnegie Mellon University; Rep. Frank Pallone, Democrat, 3rd District of New Jersey; Dr. Leonard Sagan, Program Manager, Radiation Studies Program, Electric Power Research Institute (EPRI); Robert San Martin, Deputy Assistant Secretary for Renewable Energy, Department of Energy (DOE); Regina Siferski, Chairman, Newtown Township, PA, Environmental Committee on Radiation.

Excerpts of Prepared Remarks

(in order of appearance)

Rep. Peter Kostmayer, Opening Remarks: The research results now strongly suggest an association between exposure to EMFs at power line frequencies and certain types of cancer, central nervous system disorders, reproductive abnormalities and other health problems. The health impact of EMFs may very well be the most overlooked

environmental hazard of the decade, and while it is the responsibility of scientists to assess the risk, it is the duty of Congress to determine whether the American public is being adequately informed about and protected from known and suspected hazards.

...The electric power industry, which will be represented here today by EPRI, estimates that it is spending \$6 million on EMF research, or about 40% of all funding worldwide. Industry-sponsored research can make important contributions to our knowledge. But public concerns over the credibility of health research funded by electric utilities that have an interest in the final outcome are not easily dismissed....

The federal government's record on power line health effects research is disappointing. While the DOE is budgeting \$3 million for research, a DOE advisory committee recently suggested that DOE should be doing more in the important area of epidemiology. EPA in recent years has closed down its EMF research efforts. Given both the research evidence and the potential exposure of tens of millions of Americans to power line EMFs, I find this simply unacceptable....

Rep. Frank Pallone: I would like to briefly explain the concepts of two companion bills that I will soon introduce.

The first bill would mandate a type of "prudent avoidance" by requiring that all newly constructed electric utility transmission power lines meet maximum field strength standards at the edge of the power line's right-of-way (ROW). I welcome input from any interested party as to what that standard should be.

The second bill is a research and development bill and has a public education component, as well. This bill would require a cooperative effort between DOE and EPA to do a human exposure assessment related to EMF. In addition to this assessment, I want an epidemiological study of the health effects of EMF at different levels of exposure. Another research component that is needed involves studies to improve the design of electric power transmission lines and the means by which power is conveyed to buildings where the power is used.

Finally, this bill would require EPA to develop and implement a comprehensive public information campaign to provide up-to-date materials about the health effects of exposure to electromagnetic fields and any practical means for the public to practice "prudent avoidance."

Frank De Vito: Last year, our governing body learned of a proposal by Jersey Central Power and Light Company to construct a 234 kV transmission line on 144-ft. towers over a 9.8-mile stretch running through Middletown and five other towns in our area. The line was to be erected along the NJ Transit Railroad ROW. The line would be directly abutting more than 230 homes as well as a number of grammar schools and nursery schools in our area.

As the scope of the project became more clear, the Township Committee retained counsel to fight the proposal....Middletown Township has committed well over \$100,000 of its own tax dollars to fight this 234 kV intrusion into our community. We will continue to fight and hire experts and go to court.

Regina Siberski: I recognize a need for extending research outside the controlled laboratory into actual fields of life. Total frequency identification is necessary. Serious consideration to man-made radiation from a *multitude of sources* must be prime in this hearing. Power lines must not be singled out; other users share in this serious concern. The entire frequency spectrum must be considered as it exists in the environment today.

I respectfully request that you consider the information gathered at this hearing and continue in the interest by first raising the priority level of this issue in the EPA. Do not abandon or set this important...issue aside.

Diane Allen: For a period of six months in 1989, I researched the effects that EMFs have on our everyday lives....

Research is the key...but in this case, it is also the problem....Most of the research money being spent comes from utilities. This worries many people, including me. Allowing utilities to examine and solve this problem for your constituents is tantamount to the tobacco companies being the primary researchers into hazards of cigarette smoking....I'm sorry to report to you today that in my preparation for the series, the doctors and scientists under contract to [EPRI] were the least forthcoming and the most vague about their research.

I am not saying that there is a big cover-up going on out there; rather in the endless chase for research dollars, one has to question the credibility, or objectivity, of those who might lack the will to bite the hand that feeds them.

Christopher Dodge: We are confronted with an ambiguous situation today in that, traditionally, the Soviet/Eastern European bioelectromagnetics (BEM) research community has been more concerned about the health effects of power frequency fields than its U.S./Western European counterpart. Today, in testimony at this hearing, it is evident that the U.S. and Western Europe [are] voicing greater concern about the carcinogenic effects...than [their] Soviet/Eastern European counterpart....

Clearly, public concern about this issue has been escalating over the past decade. I have been told by some BEM researchers that a majority of the BEM community at large now believes that power frequency EMFs are biologically active, whereas ten years ago, a minority shared that belief. It would now seem appropriate for the BEM research community to establish what, if any, risk there is to the general public or various occupational cohorts from chronic exposure to power frequency fields.

Dr. Granger Morgan: • Adopt a more pro-active approach [on policy-focused research needs]. • Avoid paying too much attention to high-voltage transmission lines. If we have a problem, distribution lines, building wiring and appliances may be the primary sources. • Start research on options for exposure avoidance and control. It is not clear that fields present a risk, but if it becomes clear they do, pressure will be high for *rapid* risk management action. Responding *then* in an efficient and cost-effective fashion will require careful engineering and economic studies *now*. • Undertake studies of non-adversarial policy options to avoid a storm of liability litigation against appliance manufacturers, utilities and others. • Undertake studies of how responsible companies can take exposure avoidance actions without legal consequences.

Robert San Martin: During the last ten years, some 100 challenges to construction of new transmission lines have been filed based on EMF issues. Most of these cases were resolved only after lengthy hearings. Of the six most important transmission links currently under consideration, four include EMFs among the reasons for delay....

Federally funded research in this area has been perceived as more objective than similar research funded by the electric utilities. Therefore, continued federal effort is important, not only to assure the public health and safety, but to assure the ability to strengthen the nation's electric network through new transmission and distribution facilities.

Richard Guimond: From EPA's inception, non-ionizing electromagnetic radiation has been an important element of the agency's radiation protection activities....

Presently, we are reviewing the current scientific literature relating to carcinogenicity and are writing a document that describes and critically evaluates this data....After internal technical reviews are

New ELF Funding Proposals Before Congress

completed, I anticipate that the report will be ready for review by EPA's Science Advisory Board in the summer. Based on the conclusions of this report, the agency will determine to what extent we should revise our research and operational programs....

Dr. Leonard Sagan: EPRI believes that the existing federal research program, primarily at DOE, has played a pioneering role in providing new insights in EMF biology. Despite the efforts of DOE and EPRI, the health risks of EMF exposure remain entirely hypothetical and uncertain.

Given the background of major uncertainty and of public concerns, demands may be heard for mitigation. Currently we do not know whether mitigation of fields is appropriate and, if appropriate, what parameters of exposure should be mitigated. In this environment, the proper role for the federal government is to engage in a far greater research program than formerly.... We have, for many years, encouraged this larger federal research effort.... We believe that such an expanded federal program should be comprehensive, including epidemiological studies as well as laboratory studies. The objective of this program should be ultimately to produce a risk estimate, if indeed, a risk exists.

Finally, EPRI considers it important that close communication be established and maintained among agencies involved in funding EMF research.

Dr. David Carpenter: I believe that a federal research program focused on health hazards from EMFs is essential.... Federal programs to date have been grossly inadequate, both in terms of level of effort and in terms of administration of those funds made available. At present, the major federal program, administered by DOE, has refused to apply peer review and has generally supported mediocre research. DOE is widely perceived as having too close ties to utilities to be credible in any case. NIH, which is the agency that should be involved in health-related research, has not addressed this issue appropriately. Several employees of the National Cancer Institute have been permitted to accept large sums of money for testimony on behalf of utility companies just at the time when the evidence of a correlation between magnetic field exposure and cancer incidence is becoming very strong. EPA is also an appropriate agency for administration of such a research program, but has suffered from erratic funds and interest. The result of this lack of competent and focused federal activity is that almost all research of significance other than that funded by NY State is supported by EPRI, the organization with the greatest interest in *not* finding health hazards from EMFs....

Unfortunately, our present state of knowledge is insufficient to allow reasonable exposure standards to be set. While states have an interest in this issue, the lead should be federal. To date, unfortunately, the federal government has abdicated that role to small programs such as ours in NY and to partisan organizations such as EPRI.

Jack Lee: Today, EMF is considered as a decision factor in the planning of all of our new transmission projects.... We try to avoid increasing long-term public exposure to EMF if practical alternatives exist....

BPA staff are presently developing methods for implementing the interim guidance. Basically, in NEPA documents for proposed lines, staff conduct an EMF exposure assessment. This consists of comparing EMF levels expected from the new line with levels from existing lines in alternative routes. The number of nearby homes in each route is also determined. If it appears that exposures to homes near the edge of the ROW could increase, measures are investigated for reducing EMF levels. One approach that has successfully been used is reconfiguration of the wires of multi-circuit lines. This can result in significant reduction of field strength through phase cancellation. At

other times, fields can be reduced by adjusting the location of the lines on a multiline corridor, or by adjusting the location of the ROW. Each project is evaluated on a case-by-case basis in terms of identifying practical mitigation alternatives....

James Cunningham: I appreciate this opportunity to represent LPPC, which consists of 17 of the nation's largest public power systems.... We recognize that there is a perceived bias in research funded by the utility industry. We deny this bias, but we cannot ignore the perception.

As one solution, we believe EPRI should allow appropriate federal agencies...to participate fully in the review of its scientific projects and in selection of research to be supported by the institute. This would continue EPRI's vital role in EMF research while helping to refute doubts as to its credibility.

Another approach would be for states to continue their own independent research. But, absent better coordination than has been evident thus far, there is a real danger that limited research dollars will be wasted on duplicative efforts or on studies that are not sufficiently well designed.

We are therefore proposing today a model for a national EMF research program to permit the broadest possible collection, analysis and dissemination of data. This program would be structured along the lines of the NY Power Lines Project.... The research would focus on a limited number of areas of greatest scientific and public concern and would be strongly coordinated with work by EPRI, DOE and others to avoid duplication, except where justified on scientific grounds.

Our proposal's major features include: An independent board of seven to nine national and state public officials would administer the program. The board ideally would include leaders from the fields of public health, science and utility regulation.... The board would select a scientific steering committee, which would include an EPRI representative.... Funding, approximately \$15 million to \$20 million, would come primarily from a onetime voluntary assessment on electric utilities throughout the nation. States currently pursuing independent programs of this type would be asked to consider adding their funds as well....

The program we propose will take time to complete—probably 5-8 years. But that is all the more reason to move quickly now....

Dr. Robert Becker: In the power frequency region, the data available provide not only a hazard assessment but evidence for a permissible dose rate as well. The studies of Wertheimer and Leeper, Tomenius, Savitz and, most recently, Matanoski all relate a significant increase in cancer incidence with either occupational or residential exposure to power frequency magnetic fields over 3 mG. Additional studies in this area, if they are appropriately performed, appear unlikely to materially add to this body of evidence.

I therefore propose that the following regulatory action be taken at the national level. All new construction, transmission lines, substations, distribution lines, etc., be required to produce no more than a maximum of 1 mG in any adjacent dwelling, school or public building. That exposure rates for utility workers, without protective clothing, be limited to a total dose of 1 mG x 8 hours per day. And that the combined utility companies be required to produce a plan of action to bring existing installations of the same type into compliance with these requirements by the year 2000....

I urge the reactivation of the EPA program with adequate funding for its expansion to include the entire spectrum of use of EM energy. ...In view of the politicization of the issue and the emotional content that the citizenry is presently displaying, I recommend that at least one, and possibly more, ad hoc external review panels be set up to monitor progress and ensure the adequacy of projects and reports.

CONFERENCES

New Listings

May 8-9: **Microwave Food Safety: A Special Seminar on Microwaveable Food and Packaging Issues and How & Why Microwave Heating Is Different**, Registry Hotel, Minneapolis, MN. Contact: International Microwave Power Institute, 13542 Union Village Circle, Clifton, VA 22024, (703) 830-5588.

May 21-25: **7th Biennial Nuclear EMP Meeting**, University of New Mexico, Albuquerque, NM. Contact: C.W. Jones, Metatech Corp., 2309 Renard Place, SE, Suite 401, Albuquerque, NM 87106.

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

June 19-22: **NIST EMI Metrology Short Course**, Vail, CO. Contact: Jose Cruz, NIST, MS 360, 325 Broadway, Boulder, CO 80303, (303) 497-3763.

June 30-July 4: **International Right of Way Association (IRWA) International Seminar**, Denver, CO. Contact: IRWA, 13650 S. Gramercy Place, Gardena, CA 90249, (213) 538-0233.

August 15-17: **Symposium on Antenna Technology and Applied Electromagnetics**, University of Manitoba, Winnipeg, Canada. Contact: L. Shafai, Dept. of Electrical & Computer Engineering, University of Manitoba, Winnipeg, Manitoba R3T 2N2, Canada, (204) 474-9615.

August 18-24: **9th Annual Scientific Meeting and Exhibition of the Society of Magnetic Resonance in Medicine (SMRM)**, Hilton Hotel, New York, NY. Contact: SMRM, 1918 University Ave., Suite 3C, Berkeley, CA 94704, (415) 841-1899.

September 6-7: **40th Annual Fall Broadcast Symposium**, Hotel Washington, Washington, DC. Contact: Dr. Philip Rubin, Rubin, Bednarek Associates, 1667 K St., NW, Washington, DC 20006.

September 9-14: **25th Congress Ampere on Magnetic Resonance**, Stuttgart, F.R.G. Contact: Dr. J.U. von Schütz, Physikalisches Institut, Universität Stuttgart, Pfaffenwaldring 57, D-7000 Stuttgart 80, F.R.G., (0711) 685-5273.

October 15-16: **22nd Annual North American Power Symposium**, Auburn University, Auburn, AL. Contact: Dr. Morteza Daneshdoost, Electrical Engineering Dept., Southern Illinois University at Carbondale, Carbondale, IL 62901, (618) 536-2364.

UPDATES

COMPATIBILITY & INTERFERENCE

Hearing Aid Interference...Some hearing aids may be picking up more than sound waves. A team of British doctors reported the case of a 96-year-old woman whose hallucinations were at least in part the result of RFI. The woman was initially treated with drugs. When she was hospitalized two years later, however, her hearing aid, which was resting on a bedside table, was heard broadcasting a local radio station. "We think that this happens more often than is reported," Drs. D. King and M.G.M. Malster of Liverpool Hospital and Dr. D.N. Brooks of Withington Hospital in Manchester concluded. They recommend that, "Hearing aids should be checked regularly, especially when patients complain of 'auditory hallucinations.'" They explain that many hearing aids designed to switch from a microphone to a telecoil function suffer switch corrosion, producing a connection that allows broadcast signals to be picked up and amplified. Comparable interference problems have been reported for inner-ear cochlear implants (see *MWN*, S/O85). (For more on the general problem of EMI to medical devices, see *MWN*, N/D85.) "Auditory Hallucinations' From a Hearing Aid?" appeared in the *British Medical Journal*, 299, p.1141, November 4, 1989.

EMP

Assorted Notes...In a new paper, "EMP Simulators and Public Safety: An Analysis," Drs. D.C. Agouridis and Clay Eastery of the Oak Ridge National Lab in Tennessee conclude that EMFs "produced by EMPs and EMP simulators can result in a variety of conditions, which in certain circumstances could be hazardous and/or exceed the ANSI guideline." The analysis appeared in *Bioelectromagnetics*, 10, pp.355-360, 1989. (See also *MWN*, J/A88.)...The Defense Nuclear Agency (DNA) is seeking help in determining the susceptibility of

strategic submarines to interference from high-altitude EMPs. The DNA wants to characterize EMP underwater environments and to identify and design hardening requirements and verification tests. The successful contractor will need a "secret" security clearance. The DNA notice appeared in the October 24 *Commerce Business Daily*....The USAF has awarded a \$123 million contract to the Westinghouse Electronic Systems Group for the development of EMP-resistant radios which operate in the ELF and VLF frequency bands, according to the November 6 *Defense News*....In the U.K., Electronics & Computing for Peace (ECP) has published a 34-page booklet on "Nuclear Electromagnetic Pulse." Written by Tim Williams, an electronics design engineer and founding member of ECP, the booklet gives an overview of the potential effects of EMP on power grids, communications technology and military systems. Williams concludes that EMP protection measures are "not feasible except for highly critical systems where cost is not a consideration." Copies of the booklet are available for £2.30 from: Louis Barman, ECP, 89 Acre Rd., Kingston-on-Thames, Surrey, U.K.

INTERNATIONAL

VOA Transmitter in Israel...Plans to build an 8,000 kW Voice of America (VOA) transmitter in Israel's Arava Valley have sparked concerns among environmentalists, local farmers and the Israeli Air Force. The proposed transmission station, which would beam broadcasts to Central Asia, Africa and Europe, is so powerful that the Air Force plans to move training flights of their F-16 fighters for fear that the transmitter will interfere with the planes' guidance systems. Local farmers are less than eager to live where the Air Force fears to fly. They have called attention to the potentially harmful health effects of RF radiation from the transmitter, which would be approximately eight times as powerful as the De-

UPDATES

Iano, CA, VOA transmitter currently being investigated in connection with the McFarland cancer cluster (see *MWN*, J/F88, J/A88, M/A89 and J/F90). Environmentalists, who say that the station will not only be an eyesore in the heretofore pristine valley but will also disrupt the migration of birds across the Negev desert, have called for the cancellation of the project in testimony before the U.S. Congress. The VOA and the Israeli Government have dismissed these concerns and construction will begin soon, barring a last-minute reversal.

MEETINGS

Mechanisms at BEMS...Dr. Stephen Cleary of Virginia Commonwealth University is organizing a symposium on mechanisms of interaction for the June 10-14 *Annual Meeting of the Bioelectromagnetics Society* in San Antonio, TX. The session will feature Dr. V.V. Lednev of the U.S.S.R.'s Institute for Biological Physics in Puschino, who will discuss his model of interaction which has been the focus of much interest recently, and Dr. W. Grundler of the Institute for Radiation Biophysics in Munich, F.R.G., on the effect of millimeter waves on yeast growth. Cleary and Dr. Henry Lai of the University of Washington will speak on non-thermal effects and MIT's Dr. James Weaver will review his and Dr. Dean Astumian's widely publicized model of very weak electric field effects (see *MWN*, J/F90).

PEOPLE

Ken Klein, who recently retired from DOE, has joined Energetics, Inc., a consulting firm based in Washington, DC. ...**Laurie Geissinger** is once again working on EMFs for Seattle City Light. Last year, she left the utility, where she was the EMF coordinator, to become a water resource planner. Now, Geissinger has opened her own consulting firm, *Environmental Planning and Research Associates*, on Vashon Island....**Michael Rau** has been promoted to senior vice president of science and technology at the National Association of Broadcasters. Rau, an engineer, earned a law degree in 1988.

RESOURCES

Solitons...A number of researchers have long believed that solitons, waves that do not dissipate as they propagate, may hold the key to explaining energy transfer—and therefore EMF interactions—in cells (see *MWN*, Mr83). Dr. Alwyn Scott of the University of Arizona, Tucson, clarifies these concepts in "The Solitary Wave," which appears in the March/April 1990 issue of *The Sciences*. For example: "Related to the mystery of protein energetics is the question of how the double helix of the DNA molecule comes apart during protein synthesis....The physical scientist...can point to no clear source of energy for the unzipping and reziping....If a soliton could pass up and down the double helix...it could easily provide enough energy to zip and unzip genetic material

almost indefinitely." The bimonthly magazine is published by the New York Academy of Sciences.

Biomagnetism...Andrew Skolnick calls biomagnetic imaging "one of the most exciting areas in radiology." His article, "Biomagnetometry Provides a New Compass for Exploring the Brain and Heart," appeared in the February 2, 1990 issue of the *Journal of the American Medical Association*....Three papers and a commentary appearing recently in *Nature* took a look at magnetic bacteria: "Magnetic Iron-Sulphur Crystals from a Magnetotactic Microorganism," by Brazil's Dr. Marcos Farina and his colleagues, appeared in the January 18 issue (343, pp.256-58); it was followed by "Biomagnetization of Ferrimagnetic Greigite (Fe_3S_4) and Iron Pyrite (FeS_2) in a Magnetotactic Bacterium," by a team led by Dr. Stephen Mann of the University of Bath, U.K. (pp.258-61). Dr. R.J.P. Williams of the University of Oxford, U.K., prepared a "News & Views" column to accompany the papers (pp.213-14). One week earlier, in the January 11 issue, a group headed by Dr. Jörg Fassbinder of the University of Munich, F.R.G., published "Occurrence of Magnetic Bacteria in Soil" (343, pp.161-63).

STANDARDS

CISPR on Spark-Ignited Engines...CISPR has updated its radiated limits and test methods for spark-ignited engines. This is the third edition of *Limits and Methods of Measurement of Radio Interference Characteristics of Vehicles, Motor Boats and Spark-Ignited Engine-Driven Devices* (CISPR 12, 1990), which is designed to protect AM and FM radio and TV reception inside buildings. The first edition was published in 1975, the second edition in 1978. The 77-page document is written in both English and French. A copy is available for \$75.00, prepaid, from: International Sales Department, American National Standards Institute, 1430 Broadway, New York, NY 10018, (212) 354-3300.

VDTs

Danish Pregnancy Study...The preliminary results of a new Danish epidemiological study indicate no serious reproductive risks associated with VDT work regardless of the number of hours spent at the terminal. They do show a relationship between stress and adverse pregnancy outcomes, however. The results were released on the steps of Århus City Hall on October 16, 1989. A translation of the Danish release was made available to *Microwave News* by IBM Corp. Drs. Lars Brandt and Claus Vinter Nielsen of Århus University's Institute of Social Medicine and Department of Occupational Medicine did find a "tendency for higher-stress VDT work to entail a risk of adverse pregnancy outcomes in contrast to lower-stress VDT work." It is not clear how the effects of stress were distinguished from those of VDTs. Brandt and Nielsen also identified an increased risk of a specific developmental

defect in the offspring of VDT workers. They did not specify the type of defect and dismissed its importance. Details of the study, which was based on questionnaires completed by 6,212 women encompassing 6,541 pregnancies, are still sketchy. Dr. Brandt told *Microwave News* that the full results will be made available when the paper is accepted for publication.

ETC...

Zap Trap... Pests don't like weak pulsed magnetic fields. Two Iowa inventors recently patented a device that employs household electrical current to repel rodents, the March 3 *New York Times* reports. "This does not kill rats or mice. It just affects their nervous systems so that they don't want to be in the field," according to Gary Lutz, one of the inventors.

FROM THE FIELD

Magnetic Fields from Ceiling Cable Heating Systems

Louise Young, the author of Power over People (Oxford University Press, 1973), sent us the following letter. She also sent a copy to Dr. Nancy Wertheimer, who shared her reply with us.

To the Editor:

One source of magnetic field exposure which has received very little attention is electric heating by cables installed in the ceiling. Like a giant electric blanket, this form of heating produces 60 Hz magnetic fields and the occupants of these buildings are exposed intermittently throughout the winter season.

I live in an electrically heated apartment building and I have taken many readings with my digital milligauss meter. I find that in cold weather the heating is on approximately half the time, exposing me to fields that vary from 3.5 to 12 mG, depending on the position within each room. It is not just the perimeter of the room that is bathed in high magnetic fields, as Nancy Wertheimer's studies suggest, but the main area of the room itself. The highest fields appear to be somewhat randomly located, an effect caused no doubt by the particular wiring configuration in our ceiling and its relationship to the wiring in the ceiling of the apartment below. The intensity of the fields increases near the ceiling and down toward the floor, rising to 20 mG in some locations.

Having discovered this, I measured the fields in a number of other electrically heated buildings, including one single-family home. In most of these locations the fields were in the same range as those cited above. The exception was the single-family home, where the fields were two or three times higher. The strongest fields occurred in the second floor bedrooms, varying in the range of 15 to 25 mG, and as high as 35 mG down near the floor. Holding the meter up near the ceiling, the readings went off the scale (>200 mG).

It is very disturbing to think that countless families here in the United States and throughout the world may be chronically exposed to magnetic fields that are many times the level that has been found to be associated with childhood leukemia and—to a lesser degree—many forms of adult cancer and birth defects. Electric heating is favored in apartment buildings and office buildings as well as in single-family homes. Of course, some of the occupants of these buildings also use electric blankets and video display terminals (VDTs). It occurs to me that one of the reasons for the clustering of cases of spontaneous abortion among VDT operators, for example, may be a double exposure where computers are used in office buildings that are electrically heated.

I think it is imperative that this hazard be given immediate attention. Epidemiological studies should be undertaken to determine the incidence of cancer and birth defects among people living or working in electrically heated environments. Electric blankets can be turned off without serious loss of comfort but electric heating cannot. Attention should be paid to redesigning this type of wiring so magnetic fields are not produced. Conversion to DC current is a reason-

able alternative. But what about existing systems? Would it be possible to retrofit them in a way that would significantly reduce the hazard? Much more research is needed to answer these questions.

Sincerely,
Louise B. Young
Wilmette, IL

To the Editor:

I am surprised to learn that ceiling cable electric heat is used in Illinois. It is most commonly found where electric power is (or has been) cheap, and the weather is moderate. Ed Leeper and I studied this source of magnetic field (and electric field) exposure in Oregon, but only relative to fetal loss.*

We do not contend that only the perimeter of the room will have excess magnetic field exposure—although we have traced the room-wide field to the method of stringing the wires: The ordinary back-and-forth pattern produces a good deal of cancellation of fields everywhere but at the edges, and ends up giving a field much like you would get from a wire running around the perimeter of the room. A few feet away from the ceiling this field is fairly uniform within the room.†

I do not, however, feel that the ceiling cable heat will produce a cancer risk in direct proportion to the increase in maximum field exposure. The magnetic field will only be present sporadically—when the heat is on. Also, we do not know that the effects go up linearly with intensity of exposure, especially not as intensities exceed the range (up to about 4-5 mG) explored by the epidemiological studies. I would not be at all surprised to find that at high but sporadic exposure levels the effects might be quite different from those found at moderate, more continuous exposure.

One point is clear: We need more research to find out the answers to some of these questions. My hope is that answers will now start coming from many different directions, allowing us eventually to understand better what we are studying, and how to study it.

Sincerely,
Nancy Wertheimer, PhD
Boulder, CO

* Nancy Wertheimer and Ed Leeper, "Fetal Loss Associated with Two Seasonal Sources of Electromagnetic Field Exposure," *American Journal of Epidemiology*, 129, pp.220-224, 1989. See also *MWN*, N/D88.

† In a paper presented at the IEEE's 9th Annual Conference of the Engineering in Medicine and Biology Society in 1987, Finland's Dr. Jukka Juutilainen and coworkers at the University of Kuopio reported that the measured magnetic fields in homes with ceiling cable heat were largely below 1 mG. We have not yet discussed with them possible reasons for the apparent differences between their and our results.

Brain cancer is on the rise in the U.S. Drs. Devra Lee Davis of the National Research Council and Joel Schwartz of the Environmental Protection Agency have reported that mortality from brain cancer among older white men and women approximately tripled between 1968 and 1983 (*Lancet*, i, pp.633-636, 1988).

At least eight EMF-brain tumor studies are under way around the world (see *MWN*, N/D89).

Astrocytomas Most Likely Subtype

Dr. Susan Preston-Martin and coworkers at the University of Southern California (USC) School of Medicine in Los Angeles found a significantly elevated risk of gliomas—particularly astrocytomas—among men who were likely to be exposed to EMFs on the job. For astrocytomas, the most common subtype of gliomas, the odds ratio (OR) was 4.3 and was statistically significant among those exposed for more than five years. No similar increase was observed for meningiomas.

The USC findings parallel those of a 1987 study by Dr. Terry Thomas and coworkers (see *MWN*, S/O87 and p.15). In a telephone interview, Preston-Martin said, "If there is a relationship, it looks as if astrocytomas may be the connection."

Milham, an epidemiologist with the Washington state Department of Health, agreed. "It makes perfect biological sense that an excess of only certain types of brain tumors would be observed," he said.

Preston-Martin and coworkers interviewed 272 men, ages 25-69, from Los Angeles County with primary brain tumors first diagnosed between 1980 and 1984. Among the other risk factors considered were on-the-job chemical exposures, smoking, alcohol and serious head traumas. Their paper, a general survey of brain tumor risk factors, was published in the November 1, 1989 issue of *Cancer Research*. A detailed analysis of the EMF findings was submitted for publication in February, Preston-Martin told *Microwave News*.

Preston-Martin is also working on a study of childhood brain tumors and residential EMF exposures, which is being funded by the state of California (see *MWN*, J/A89).

Parental Occupational Exposures

Drs. Christine Cole Johnson and Margaret Spitz found that children whose fathers were employed in jobs involving EMF exposures had a 60% increased risk of brain and central nervous system tumors, which was statistically significant. Among children of electricians, the risk was three-and-a-half times the expected rate.

Four of the seven children of electricians in the study were diagnosed with tumors in the brain stem.

"It is conceivable that [EMF] exposures could play a role in the genesis of mutations or tumors, although convincing evidence has yet to be reported," Johnson and Spitz concluded in their paper. Johnson is with the Henry Ford Hospital in Detroit, MI, and Spitz is with the M.D. Anderson Cancer Center at the University of Texas in Houston.

"If there is an effect from EMFs, it has to be on the germ cell," Spitz told *Microwave News*. She added that studies at the molecular level are needed to confirm this. Johnson was not available for an interview.

Johnson and Spitz studied children in Texas who died between 1964 and 1980 and whose fathers were employed in industries involving EMF exposures at the time of the children's births.

The researchers caution that some agent other than EMFs—e.g., chemicals—might have been at work. For example, they found an OR of 10.0 for construction electricians, who "work largely with unenergized wiring," but who also are exposed to numerous solvents. Their paper appeared in the *International Journal of Epidemiology*.

Johnson and Spitz previously reported an association between childhood neuroblastoma risks and paternal occupational EMF exposures (see *MWN*, J/A85). At that time, they speculated that magnetic fields might function as weak cancer promoters.

The Evidence Grows

In the June 1988 issue of the *American Journal of Industrial Medicine*, Dr. Marjorie Speers and coworkers reported an increased risk of brain tumors among Texas workers in jobs associated with EMF exposures. For utility workers, the risk was 13 times the expected rate.

In an editorial accompanying Speers's report, Dr. Baruch Modan of the Tel Aviv University Medical School in Israel concluded that, with respect to brain tumors, "EM energy, which is with us to stay, must be considered an environmental hazard and dealt with accordingly, until proven otherwise."

Prior to the Speers study, Drs. Milham, Thomas and Ruey Lin had each found increased brain tumor risks associated with occupational EMF exposures. Dr. David Savitz's study of childhood cancer showed a doubling of brain tumor risk among children living near high-current power lines.

Last year, two unpublished studies provided further evidence of the brain tumor-EMF association. Savitz and co-worker Dr. Dana Loomis found that electrical workers had significantly elevated mortality from brain tumors. "These results are certainly more suggestive of an effect on brain cancer as compared to leukemia," Savitz said (see *MWN*, N/D89). And last November, Drs. Genevieve Matanoski and Patrick Breyse reported that telephone cable splicers had a 70% increased risk for brain tumors (see *MWN*, N/D89).

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EMF Brain[†] Tumor Studies

Ruey S. Lin et al., "Occupational Exposure to Electromagnetic Fields and the Occurrence of Brain Tumors: An Analysis of Possible Associations," *Journal of Occupational Medicine*, 27, pp.413-419, June 1985 (see MWN, O84 and J/A85).

Samuel Milham, Jr., "Mortality in Workers Exposed to Electromagnetic Fields," *Environmental Health Perspectives*, 62, pp.297-300, 1985 (see MWN, M/A86).

Terry L. Thomas et al., "Brain Tumor Mortality Risk Among Men with Electrical and Electronics Jobs: A Case-Control Study," *Journal of the National Cancer Institute*, 79, pp.233-238, August 1987 (see MWN, S/O87).

Marjorie A. Speers, James G. Dobbins and Van S. Miller, "Occupational Exposures and Brain Cancer Mortality: A Preliminary Study of East Texas Residents," *American Journal of Industrial Medicine*, 13, pp.629-638, 1988 (see MWN, J/A88).

David A. Savitz et al., "Case-Control Study of Childhood Cancer and Exposure to 60 Hz Magnetic Fields," *American Journal of Epidemiology*, 128, pp.21-38, 1988 (see MWN, N/D86 and J/A87).

D.P. Loomis and D.A. Savitz, "Brain Cancer and Leukemia Mortality Among Electrical Workers," Abstract, *American Journal of Epidemiology*, 130, p.814, 1989 (see MWN, N/D89).

Christine Cole Johnson and Margaret R. Spitz, "Childhood Nervous System Tumours: An Assessment of Risk Associated with Paternal Occupations Involving Use, Repair or Manufacture of Electrical and Electronic Equipment," *International Journal of Epidemiology*, 18, pp.756-762, 1989 (see p.1).

Susan Preston-Martin, Wendy Mack and Brian E. Henderson, "Risk Factors for Gliomas and Meningiomas in Males in Los Angeles County," *Cancer Research*, 49, pp.6137-6143, November 1, 1989 (see p.1). Detailed paper in press.

Genevieve Matanoski, Elizabeth Elliott and Patrick Breyse, "Cancer Incidence in New York Telephone Workers," presented at the *Annual Department of Energy-Electric Power Research Institute Contractors Review*, November 15, 1989, Portland, OR (see MWN, N/D89).

Risk increased with EMF exposure; odds ratio (OR) = 2.15 for "definite EM exposure." The average age at death was significantly lower among workers with presumed high exposures.

Among electricians, there was a 55% increased risk of brain tumors ($p < 0.01$); for all occupations with EMF exposure, the increased risk was 23% ($p < 0.05$).

Astrocytic tumor risks increased with duration of electrical employment; among those employed for less than five years, relative risk (RR) = 3.3; for employment of 5-19 years, RR = 7.6; and for 20 years or more, RR = 10.4 ($p < 0.05$).

Workers in jobs associated with EMF exposure had an OR = 3.94. Among utilities workers alone, OR = 13.10 (statistically significant). As in Lin's study, there was a "linear relationship between the probability of exposure to [EMFs] and brain cancer."

Children living near high-current power lines had an OR = 2.04 (statistically significant), compared to those living near low-current lines (based on wire codes).

Electrical and electronic technicians had the highest risk of brain tumors (OR = 3.1), followed by electric power repairers and installers (OR = 2.4). For all electrical workers, OR = 1.5 (statistically significant).

Children of fathers who were electricians had a significantly elevated risk of nervous system tumors (OR = 3.5, $p < 0.05$); four of the seven children of electricians had tumors in the brain stem. Overall risk for those whose fathers worked in jobs with potential EMF exposures was 1.6 ($p < 0.07$).

Occupational EMF exposures were associated with higher risks of gliomas. The link was strongest with astrocytomas for exposures of > 5 years—a statistically significant OR = 4.3. Risk increased with years on the job (for trend, $p = 0.008$).

New York Telephone cable splicers had an elevated risk of brain tumors; OR = 1.79 For all cancers, OR = 1.8 (statistically significant). Average exposure levels were 4.3 mG.

[†] Three other studies link EMF exposure to central nervous system (CNS) cancer. Brain tumors are by far the most prevalent type of CNS cancer. See Nancy Wertheimer and Ed Leeper, "Electrical Wiring Configurations and Childhood Cancer," *American Journal of Epidemiology*, 109, pp.273-284, 1979; Lennart Tomenius, "50 Hz Electromagnetic Environment and the Incidence of Childhood Tumors in Stockholm County," *Bioelectromagnetics*, 7, pp.191-207, 1986; Nancy Wertheimer and Ed Leeper, "Magnetic Field Exposure Related to Cancer Subtypes," *Annals of the New York Academy of Sciences*, 502, pp.43-53, July 2, 1987 (relates to adult cancer).

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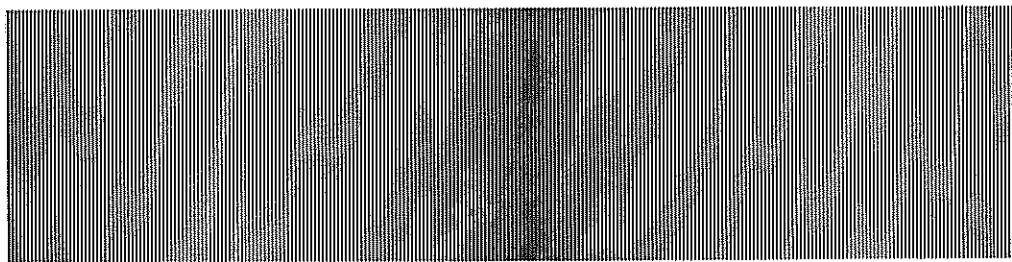
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MICROWAVE NEWS



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A Report on Non-Ionizing Radiation

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Deciphering Wire Codes: USC Data Analysis Continues

With the release of Dr. John Peters's findings of a significant association between childhood leukemia and wire codes—but only a weak, nonsignificant association with measured electromagnetic fields (EMFs)—researchers are again asking: What do wire codes reveal about EMF exposures that short-term and spot measurements do not?

Among the variables under study are high frequency transients, angles of the magnetic fields, the earth's magnetic field, resonance conditions, on-and-off field exposures, ground currents and harmonics—as well as non-EMF factors, such as traffic density.

Dr. Nancy Wertheimer told *Microwave News* that a number of researchers who attended the Electric Power Research Institute's (EPRI) workshop, held February 5-8 in Carmel, CA, felt that, "There seems to be something with wire codes—let's find out what it is." Wertheimer and Ed Leeper, both based in Boulder, CO, devised wire coding as a method to estimate residential magnetic field exposures for their landmark 1979 study.

Peters, an epidemiologist at the University of Southern California (USC) in Los Angeles, presented preliminary results of his study at the EPRI workshop (see *MWN*, J/F91 and p.13). EPRI sponsored the USC study.

Data analysis on the five-year study continues. Dr. Joseph Bowman, a member of Peters's team, told *Microwave News*, "We have a lot more data than went into the report that EPRI released." Bowman, who recently left

(continued on p.12)

NIOSH Finds No VDT Miscarriage Risk; EMF Conclusion Sparks Debate

Telephone operators who use conventional cathode ray tube (CRT) video display terminals (VDTs) are no more likely to miscarry than are those who use other types of displays, according to a long-awaited epidemiological study by the National Institute for Occupational Safety and Health (NIOSH) in Cincinnati, OH. The NIOSH team did not find a dose-response relationship between the number of hours spent at a VDT and the risk of miscarriage, and there was no evidence of an excess risk when the data were broken down into early and late miscarriages.

NIOSH will use the same data set for a study on VDTs and birth defects, low birth weight and pre-term births—these results are expected to be released in about a year and a half.

In the March 14 issue of *The New England Journal of Medicine*, Dr. Teresa Schnorr and coworkers concluded that, "The use of VDTs and exposure to the accompanying electromagnetic fields [EMFs] were not associated with

(continued on p.10)

« Power Line Talk »

As the invited luncheon speakers at *Transmission & Distribution* magazine's *Conference on Electric and Magnetic Fields* on February 26, U.S. Rep. Frank Pallone (D-NJ) and *The New Yorker's* Paul Brodeur expressed concerns about past utility funding of EMF research and the move toward joint utility-government sponsorship. Asked during Q&A about this funding strategy proposed by the Large Public Power Council and now being pursued by the Health Effects Institute (see *MWN*, M/J90 and p.6), Pallone warned that it is necessary to avoid even the appearance of bias. Brodeur charged that the industry is dealing with EMFs as a public relations problem instead of as a medical issue. He asked the conferees whether they were "beginning to realize that EPRI has been telling you all this time not what you needed to know but what it thought you wanted to hear?" He challenged the positions of EEPA, EEI, EPRI, ERI and IEEE, branding them "wagons of the electric utility industry's E-train." Brodeur issued a warning: "As the lawsuits proliferate, so will damage awards, out-of-court settlements and legal costs....there will be a firestorm of public outrage that will result in major regulatory changes in the way utilities are allowed to conduct their business."

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Does living near power lines increase the risk of developing cancer? The *Journal of the American Medical Association* posed this question to Dr. David Savitz of the University of North Carolina in Chapel Hill. In his response, published in the March 20 issue, Savitz said: "Most reviewers of [the scientific literature] conclude that it falls short of demonstrating a causal relationship.... Nonetheless, from a public health perspective, [there] are clear suggestions of potential adverse effects on health that should be taken seriously." Ongoing research should help resolve the uncertainty, he added, predicting "substantial progress" in the next two to three years. In the meantime, the present level of knowledge is a "sufficient basis for some concern," Savitz advised, "but not necessarily action."

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The U.K.'s National Radiological Protection Board (NRPB) has joined the call for more research into EMF health effects. The lead editorial in the February 1991 issue of the NRPB's *Radiological Protection Bulletin* states that no firm EMF-cancer link has been established but adds that, "It is essential, however, that sufficient research in this area continues to be undertaken, covering epidemiology, experimental and theoretical studies, to enable exposure standards to be confirmed or revised if necessary on the basis of developing scientific knowledge." The NRPB is in the process of reviewing EPA's report on EMFs and cancer (see *MWN*, J/F91).

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In January, the Colorado Public Utilities Commission (PUC)

adopted rules requiring utilities to provide new customers with information that compares the cost of extending electric service to the cost of alternative photovoltaic solar power. Although the PUC points to the positive economics of solar energy, the new rules may be the result of a December 1989 PUC statement which cited the need for alternative power supply sources to reduce EMF levels from power lines. That report recommended a policy of prudent avoidance, stating that utility system upgrades are "no longer acceptable" unless efforts are made to "reduce or mitigate the necessity" for such enhancements (see *MWN*, N/D89). In that decision, the PUC granted permission for two new high voltage power lines. However, on February 7, Douglas County Judge Thomas Curry reversed the PUC's approval of the lines—but did prudent avoidance get struck down also? Stay tuned.

« « « » » »

The *Los Angeles Times* has set a precedent by becoming the first major American daily to cover the EMF controversy on its editorial page. In the February 11 issue, the *Times* editors made the case for further research into EMF health effects, citing the Peters study (see p.13) as the latest indication that, "Something is going on...." They, like many others, recommended a strategy of "prudent avoidance" until more is known about the EMF-cancer link. The February 24 *Times* featured an op-ed piece by Peter Asmus, author of the book *In Search of Environmental Excellence*, who argued that EMFs are fast emerging as the "utility environmental issue of the 1990s" and concluded that, "In this era of environmentalism, utilities as well as other businesses need to learn how to respond effectively to public concerns and to include the public as stake holders in future decision making. With the stakes so high on both sides, it makes sense to start by talking." The *Nashville Banner* took a similar position in a March 26 editorial expressing concern over magnetic fields at a school located next to a 69 kV power line and a 13.8 kV power line. Magnetic fields, measured by an engineer from Nashville Electric Service for the Tennessee paper, ranged from 4 mG in the hallways to 58 mG at the entrance to the band room, directly above the school's main electrical panels. The editors endorsed a policy of prudent avoidance, advising that, "High levels should bring concern not panic."

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The attention generated by "Calamity on Meadow Street," Paul Brodeur's July 9, 1990 *New Yorker* installment, has prompted EPRI to publish a booklet to help utilities respond to public inquiries. *Cluster Analyses Do Not Support "Calamity on Meadow Street" Claims*, prepared by Robert Banks Associates of Minneapolis, MN, disputes Brodeur's claim that cancer clusters in Guilford, CT, and Dukeville, NC, were due to EMFs and were not adequately investigated by state health authorities. The report further asserts that Brodeur misrepresented or ignored evi-

dence which contradicted his conclusions. A third cluster reported by Brodeur, in Montecito, CA, is not addressed in the EPRI booklet. The IEEE's Committee on Man and Radiation (COMAR)

is circulating another critique of Brodeur's articles, "*Currents of Death*" Rectified. A number of COMAR members contributed to the report, which was edited by Dr. Eleanor Adair.

EMF Litigation Heats Up

138 kV Line Challenged in Ohio

A number of Cleveland, OH, business executives have filed suit to block construction of a 138 kV, double circuit transmission line which would run along their street. In a complaint filed on March 12 in Cuyahoga County Court, they charge that electromagnetic fields (EMFs) from the line would endanger approximately 850 people who work along the street and would reduce property values.

The businessmen, who belong to the Lakeside Area Development Corporation (LADCO), at the same time filed a motion for a preliminary injunction to stop construction of the line, which is due to become operational by July 1. A hearing on the motion is set for May 2. The plaintiffs are being represented by attorney Richard Siegel of Cleveland.

The defendants named in the suits are Cleveland Public Power (CPP), the City of Cleveland (which owns CPP), Cleveland Electric Illuminating (CEI) and the Ohio Public Siting Board (OPSB) of the Public Utilities Commission. The board certified the line as safe and necessary on October 29, 1990.

In a third legal action in March, the owners petitioned the OPSB to reopen its docket on the line (No.88-1092-EL-BTX), known as the 138 kV Inland-Lake Shore Transmission Line. They contend that the siting board should have considered possible health risks and that they should have been notified of the board's September 17, 1990 public hearing, since they may be harmed by the line.

The OPSB had previously rejected an informal request by LADCO to review its decision. In a January 31 letter to LADCO President Dennis Frinzi, OPSB Chairwoman Jolynn Barry Butler said that the board would not reconsider its approval for the line. At the same time, she explained that the board's staff was investigating possible EMF health effects in a separate action.

In the petition, the business executives charge that the OPSB's refusal to consider EMF health effects in the Inland-Lake Shore case is "tragically ironic," and that "the medical and scientific communities must be heard from *before* the men and women who work [on their street] are placed at risk."

The business owners contend that operation of the line will be a "medically and scientifically recognized endangerment to the health, safety and well-being" of people working nearby. They also allege that the anticipated presence of the lines and the resulting EMFs "have adversely affected and diminished the value and marketability" of their properties.

The 20-mile line would travel along "uninhabited and seldom populated railroad rights-of-way *except* for a one-half-mile span which... pass[es] directly through and over a densely

populated work site....," according to the documents filed by the plaintiffs. All of the companies filing suit are located in that span, according to James Gallo of Gallo Displays, Inc., the lead plaintiff.

"We're trying to buy time," Gallo told *Microwave News*, until the OPSB reconsiders the line on the basis of potential health effects. "We want a power line, but we want a safe power line," he added. Gallo pointed out that the line would be 22 feet from his office and that projected magnetic field levels there would be as high as 350 mG. The estimates were prepared by Bob Huffey, an engineer who is a partner in one of the plaintiff companies.

In addition to forcing a reevaluation of the line, the plaintiffs are seeking lawyers' fees, costs and unspecified compensatory damages. The businesses expect to spend \$150,000 on their legal challenges, according to Gallo.

Along with Gallo Displays, the plaintiffs are Beverage Distributors, Inc., Hexagraphics, Inc., Milner Electric Co. and G.R.Z. Properties Co.

Michael Konicek, director of public utilities for the city, told *Microwave News* that he did not want to comment on the case because it is in court. The defendants have not yet filed their responses to the challenges.

Utility Worker's Widow Files Claim

A Seattle, WA, widow claims that her husband's death was caused by his exposure to EMFs while working for Seattle City Light, a public utility. Robert Pilisuk died on April 29, 1989, at age 44, from pneumonia brought on by acute lymphoblastic leukemia.

Pilisuk's widow, Mimi, filed a pension claim on March 20 with the Washington Department of Labor and Industries in Olympia. If successful, she could receive up to \$21,000 per year.

Seattle attorney Michael Withey, who is representing Pilisuk, told *Microwave News* that, "This is the first EMF-related pension claim in Washington that I know of." Withey, who is with the Seattle firm of Schroeter, Goldmark & Bender, was also the lead attorney in a major electromagnetic pulse suit (see box on p.4).

Pilisuk's claim is supported by an accompanying letter from Dr. Peter Wright, a medical doctor, stating that Pilisuk's leukemia, first diagnosed in 1987, resulted "on a more probable than not basis, from his employment by Seattle City Light." Pilisuk worked for the utility as an apprentice and journeyman electrician from 1982 until his death, including duty as a cable splicer and as a maintenance electrician.

Preliminary results released in 1989 of an ongoing epidemi-

Attorneys Form Group To Aid EMF Plaintiffs

Lawyers from all across the country have joined forces to evaluate potential electromagnetic field (EMF) cases and litigate on behalf of plaintiffs. The ten-member Electromagnetic Radiation Case Evaluation Team (EMRCET) will seek cases with the potential to set legal precedents.

"We feel that it is important to develop a protocol for the evaluation of electromagnetic radiation cases," the group's founder, Michael Withey of Schroeter, Goldmark & Bender in Seattle, WA, told *Microwave News*. Many previous EMF lawsuits did not establish permanent legal records because they were settled out of court, with the terms kept confidential. (For more on EMF litigation, see *MWN*, Ap81, D82 and S/O89.)

EMRCET members will provide a service to attorneys by investigating and evaluating their EMF cases. They will offer testimony and counsel to citizens' groups and individual plaintiffs. EMRCET was conceived at a November 1990 seminar, *Electromagnetic Fields: Science, Medicine and Public Health*, which was sponsored by the Robert Carl Strom Foundation of Seattle, WA, and Trial Lawyers for Public Justice (TLPJ), a Washington, DC, public interest legal foundation.

"As a consequence of the growing concern about this issue we are going to see more and more EMF litigation," Bruce DeBoskey of Silver & DeBoskey in Denver, CO, one of the organizers of EMRCET, said in a telephone interview. DeBoskey represented Beryl and Maelma Main, who settled a personal injury suit in 1990 alleging that Beryl's non-Hodgkin's lymphoma was caused by RF radiation from an FM transmitter next to their property. The terms of the award were not disclosed (see *MWN*, S/O89 and M/J90).

Withey was the lead attorney representing Robert Strom,

a Boeing technician who charged that his leukemia resulted from exposure to electromagnetic pulse (EMP) radiation (see *MWN*, N/D88 and M/J89). In a September 1990 out-of-court settlement, Boeing and codefendants agreed to pay Strom \$500,000 and to sponsor a medical program for approximately 700 EMP-exposed workers (see *MWN*, S/O90). Strom used part of his award to set up the Robert Carl Strom Foundation, an EMF information center. Another member of the new EMF law group, William Rossbach of Rossbach & Whiston in Missoula, MT, assisted with the Strom litigation.

The other members of EMRCET are: David Bossart of Conmy, Feste et al. in Fargo, ND; James Browne of James Browne & Associates in Oklahoma City, OK; Macon Cowles of Williams, Trine et al. in Boulder, CO; Anthony Farmer in Knoxville, TN; Kieron Quinn of Quinn, Ward & Kershaw in Baltimore, MD; Anthony Roisman of Cohen, Milstein et al. in Washington, DC; and Aaron Simon of Kazan, McClain et al. in Oakland, CA.

In 1981, Stuart Lemle, a Washington, DC, attorney, and Barton Reppert, a Washington-based journalist, established the Microwave Radiation Information and Action Center to help victims of injuries from exposure to RF/MW radiation (see *MWN*, S81). At the time they were involved in a Freedom of Information Act suit to force the federal government to release materials on Soviet irradiation of the U.S. Embassy in Moscow (see *MWN*, Ja81). Lemle also represented Marie Lafferty, the widow of an FM radio technician who died of leukemia. Lafferty, who claimed that her husband was not adequately warned of the health risks associated with exposures to RF radiation, settled her suit out of court in 1989 (see *MWN*, M/J86 and S/O89).

ological study of telephone linemen showed that cable splicers had significantly elevated rates of a number of different cancers, especially leukemia (see *MWN*, N/D89).

As part of Pilisuk's claim, Withey submitted measurements indicating that, on the average, City Light cable splicers are exposed to 204 mG and constructors, apprentices and helpers are exposed to 13 mG. The data were collected for the Electric Power Research Institute (EPRI) by Dr. Joseph Bowman of the University of Southern California School of Medicine in Los Angeles (see *MWN*, J/F88). Bowman is now at the National Institute for Occupational Safety and Health (NIOSH) in Cincinnati, OH.

In a letter accompanying the claim, Withey and Sidney Stillerman Swan, also of Schroeter, Goldmark & Bender, also suggested that a leukemia cluster may exist at City Light. Citing Dr. Samuel Milham's 1982 epidemiological study of Washington State electrical workers and leukemia (see *MWN*, J/A82), the lawyers wrote that nine or ten of the cancer cases included in those results were electricians who worked for City Light.

Two New Studies Link Worker EMF Exposures to Leukemia

The results of epidemiological studies from the U.S. and France support the hypothesis that workers exposed to electromagnetic fields (EMFs) have an increased risk of leukemia.

A recent survey by the National Institute for Occupational Safety and Health (NIOSH) showed an excess of leukemia deaths among men exposed on the job to EMFs. The NIOSH team, led by Dr. Cynthia Robinson, concluded that the results were "a confirmation that occupational exposure in electrical occupations may be associated with enhanced leukemia risk."

With regard to past occupational studies, the researchers noted a "consistency" of an elevated risk for telephone linemen and installers and for telephone, telegraph and related communications equipment operators. "It's just another indication that we need to look into the excess of leukemia among workers exposed to EMFs," Robinson told *Microwave News*. The team