CONFERENCES

1994 Conference Calendar

January 5-8: **National Radio Science Meeting,** University of Colorado, Boulder. Contact: Prof. E. K. Smith, Dept. of Electrical Engineering, University of Colorado, Campus Box 425, Boulder, CO 80309, (303) 492-7123.

January 20-21: **Electric and Magnetic Fields,** Grand Hotel, Washington, DC. Will be repeated February 7-8 at the Pan Pacific Hotel in San Francisco, CA. Contact: Executive Enterprises Inc., 22 West 21st St., New York, NY 10010, (800) 831-8333.

January 30-February 3: **1994 Winter Meeting of the IEEE Power Engineering Society (PES),** New York, NY. Contact: PES Special Services, IEEE, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855, (908) 562-3881.

February 15-18: **2nd Annual Wireless Symposium and Exhibition,** Convention Center, Santa Clara, CA. Contact: Wireless Registration, PO Box 3379, Frederick, MD 21705, or call Mary Begley, (201) 393-6289.

February 24-25: **Understanding & Controlling ELF/VLF Magnetic and Electric Fields,** Sheraton Tara Inn, Lexington, MA. Contact: Ergonomics Inc., PO Box 964, Southampton, PA 28966, (215) 357-5124.

March 2-4: **9th Annual Convention & Exposition of Cellular Telecommunications Industry Association (CTIA),** Convention Center, San Diego, CA. Contact: CTIA Wireless '94, PO Box 3379, Frederick, MD 21705, (202) 785-0081.

March 5-9: **1st Meeting and Exhibition of the Society of Magnetic Resonance (SMR),** Loews Anatole Hotel, Dallas, TX. SMR was formed when SMRM and SMRI merged; see pp.16-18. Contact: SMR, 213 W. Institute Pl., Suite 501, Chicago, IL 60610, (312) 751-2590.

March 14-15: **3rd Nordic Workshop on Biological Effects of Low Frequency Electromagnetic Fields,** Umeå, Sweden. Contact: Dr. Kjell Hansson Mild, National Institute of Occupational Health, Box 7654, S-907 13 Umeå, Sweden, (46+90) 165098.

March 14-16: **1994 EPRI EMF Seminar: Focus on Research,** Marriott Hotel, Santa Clara, CA. Contact: Robert Banks Associates Inc., EPRI EMF Seminar, PO Box 141049, Minneapolis, MN 55414, (612) 623-4600.

March 20-24: **1994 Conference and Exhibition of the National Association of Broadcasters (NAB),** Convention Center, Las Vegas, NV. Contact: NAB '94, 1771 N. St., NW, Washington, DC 20036, (800) 342-2460.

March 20-24: **1994 Electricity Conference & Exposition,** Westin Harbour Castle Convention Centre, Toronto, Canada. Contact: Canadian Electrical Association, 1 Westmount Sq., Suite 1600, Montreal H3Z 2P9, Canada, (514) 937-6181.

March 21: **Reducing EMF Exposure: Alternative Design Techniques,** Stouffer Hotel, Nashville, TN. Contact: Karen Krzmarzick, American Public Power Association, 2301 M St., NW, Washington, DC 20037, (202) 467-2921.

March 29-31: **1994 IEEE National Radar Conference,** Atlanta, GA. Contact: Joseph Bruder, Georgia Tech Research Institute, Georgia Institute of Technology, Atlanta, GA 30332, (404) 528-7745.

April 4-8: **4th International Symposium on Microwave Processing of Materials and Spring Meeting of the Materials Research Society,** Marriott Hotel, San Francisco, CA. Contact: Dr. Magdy Iskander, Dept. of Electrical Engineering, University of Utah, Salt Lake City, UT 84112, (801) 581-6944.

April 5-7: **2nd International Conference on Ultra-Wideband, Short-Pulse Electromagnetics,** Polytechnic University, Brooklyn, NY. Contact: Prof. L. Carin, Weber Research Institute, Polytechnic University, 6 MetroTech Center, Brooklyn, NY 11201, (718) 260-3876.

April 6-7: **30th Annual Meeting of the National Council on Radiation Protection and Measurements (NCRP): Extremely Low Frequency Electromagnetic Fields,** Crystal City Marriott, Arlington, VA. Contact: NCRP, 7910 Woodmont Ave., Suite 800, Bethesda, MD 20814, (301) 657-2652.

April 10-15: **1994 IEEE/PES Transmission and Distribution Conference and Exposition,** McCormick Place, Chicago, IL. Contact: Kenneth Bow, Dow North America, PO Box 515, Bldg. B, 3825 Columbus Rd., SW, Granville, OH 49023, (614) 587-4386.

April 21-22: **The Lancet Challenge of Breast Cancer Conference,** Holiday Inn Crowne Plaza, Bruges, Belgium. Contact: Conference Secretariat, Elsevier Science Publishers Ltd., Mayfield House, 256 Banbury Rd., Oxford OX2 7DH, U.K., (44+865) 512242.

April 24-29: **78th Annual Convention of the Federation of American Societies for Experimental Biology,** Anaheim, CA. Four symposia on EMF interaction with biological systems will by held on April 26. Contact: Dr. Allan Frey, 11049 Seven Hill Lane, Potomac, MD 20854, (301) 299-5181.

April 29-May 4: **1994 Joint Meeting of the Radiation Research Society (RRS) and the North American Hyperthermia Society,** Stouffer Hotel, Nashville, TN. Contact: RRS, 2021 Spring Rd., Suite 600, Oak Brook, IL 60521, (708) 751-2881.

May 5-6: **EPRI Workshop on the Measurement of Power System Magnetic Fields,** Lenox, MA. Will be repeated in September. Contact: Mary Fitzgerald, High-Voltage Transmission Research Center, 1000 E. New Lenox Rd., Lenox, MA 01240, (413) 494-4359.

May 22-26: **26th Annual National Conference on Radiation Control,** Hilton and National Convention Center, Williamsburg, VA. Contact: Conference of Radiation Control Program Directors, 205 Capital Ave., Frankfort, KY 40601, (502) 227-4543.

May 22-27: **185th Meeting of the Electrochemical Society,** Hilton Square Hotel, San Francisco, CA. Contact: Brian Rounsavill, Electrochemical Society, 10 S. Main St., Pennington, NJ 08534, (609) 737-1902.

May 23-27: **1994 IEEE MTT-S International Microwave Symposium,** San Diego, CA. Contact: 1994 MTT-S Symposium, c/o LRW Associates, 1218 Balfour Dr., Arnold, MD 21012, or call Cheryl Trondle, (619) 569-5000.

May 30-June 3: **1994 Euro Electromagnetics International Symposium: Electromagnetic Environments and Consequences (EUROEM),** Bordeaux, France. Contact: H.V. Dhur, EUROEM 94, Centre d'Etudes de Gramat, 46500 Gramat, France, (33+65) 105406.

June 1-3: **1994 IEEE Frequency Control Symposium,** Westin Hotel, Boston, MA. Contact: Michael Mirarchi, Synergistic Management Inc., 3100 Route 138, Wall Township, NJ 07719, (908) 280-2024.

June 12-17: **16th Annual Meeting of the Bioelectromagnetics Society (BEMS),** Sheraton Hotel, Copenhagen, Denmark. Contact: Dr. William Wisecup, W/L Associates Ltd., 120 W. Church St., Frederick, MD 21701, (301) 663-4252.

June 14-16: **International Electric Research Exchange Workshop on Underground Cables,** Toronto, Canada. Contact: Dr. J.M. Braun, Ontario Hydro Research Division, 700 University Ave., Toronto M5G 1X6, Canada, (416) 207-6874.

June 15-18: **28th Annual Meeting of the Society for Epidemiologic Research (SER),** Fontainebleau Hilton, Miami Beach, FL. Contact: SER, 2007 E. Monument St., Baltimore, MD 21205, (410) 955-3441.

June 19-24: **1994 IEEE AP-S International Symposium and URSI Radio**

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Science Meeting, University of Washington, Seattle. Contact: Jan Kvamme, Engineering Professional Programs, 3201 Fremont Ave. N., Seattle, WA 98103, (206) 543-5539.

June 20-24: **1994 International Symposium on Charge and Field Effects in Biosystems,** Virginia Commonwealth University (VCU), Richmond. Contact: Kelly Roach, Dept. of Chemistry, VCU, 1001 W. Main St., Box 2006, Richmond, VA 23284, (804) 367-1298.

June 26-30: **39th Annual Meeting of the Health Physics Society (HPS),** Hilton & Towers, San Francisco, CA. Contact: HPS Administrative Services, 8000 Westpark Dr., Suite 130, McLean, VA 22102, (703) 790-1745.

June 27-July 1: **1994 Conference on Precision Electromagnetic Measurements,** Boulder, CO. Contact: Gwen Bennett, National Institute of Standards and Technology, 325 Broadway, Boulder, CO 80303, (303) 497-3295.

June 28-July 1: **12th International Wroclaw Symposium and Exhibition on Electromagnetic Compatibility (EMC),** Wroclaw, Poland. Contact: W. Moron, EMC Symposium, Box 2141, 51-645 Wroclaw 12, Poland, (48+71) 481041.

July 24-28: **1994 Summer Meeting of the IEEE PES,** San Francisco, CA. Contact: PES Special Services, see January 30-February 3, above.

July 25-27: **29th Microwave Power Symposium,** Sheraton Center Hotel, Chicago, IL. Contact: International Microwave Power Institute, 10210 Leatherleaf Ct., Manassas, VA 22111, (703) 257-1415.

August 6-12: **2nd Meeting and Exhibition of the Society of Magnetic Resonance (SMR),** Hilton & Towers, San Francisco, CA. SMR was formed recently in a merger; see pp.16-18. Contact: SMR, 1918 University Ave., Suite 3C, Berkeley, CA 94704, (510) 841-1899.

August 22-26: **1994 IEEE International Symposium on Electromagnetic Compatibility,** Chicago, IL. Contact: IEEE, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855, (908) 562-3875.

August 29-September 3: **1994 Session of CIGRÉ,** Palais des Congrès, Paris, France. Contact: Andrew Corry, CIGRÉ, PO Box 310, W. Hyannisport, MA 02672, (508) 771-0488.

September 5-7: **9th International Conference on Electromagnetic Compatibility,** University of Manchester, U.K. Contact: Louise Bousfield, Conference Services, Institution of Electrical Engineers, Savoy Place, London WC2R 0BL, U.K., (44+71) 344-5477.

September 12-13: **1994 EMF Conference and Debate,** Crystal Gateway Marriott, Arlington, VA. Contact: Betsy Hidalgo, *Transmission & Distribution* Magazine, Intertec Publishing Corp., PO Box 12901, Overland Park, KS 66282, (913) 967-1865.

September 18-21: **6th Conference of the International Society for Environmental Epidemiology** and **4th Conference of the International Society for Exposure Analysis,** Sheraton Imperial Hotel, Research Triangle Park, NC. Contact: Jeana Foley, Dept. of Epidemiology, University of North Carolina School of Public Health, CB#7400, McGavran-Greenberg Bldg., Chapel Hill, NC 27599, (919) 966-7438.

September 18-23: **8th Gordon Research Conference on Bioelectrochemistry,** Kloster Irsee, Germany. Contact: Dr. Martin Blank, Dept. of Physiology, Columbia University, 630 W. 168th St., New York, NY 10032, (212) 305-3644.

September 19-20 (date may change): **44th Annual Broadcast Symposium,** Washington, DC. Contact: Gerald Berman, Voice of America, Rm. 4242, Cohen Bldg., 330 Independence Ave., SW, Washington, DC 20547, (202) 619-3771.

September 21-23: **6th International Conference on Harmonics in Power Systems,** Bologna, Italy. Contact: Prof. Gian Montanari, Instituto di Elettrotecnica Industriale, University of Bologna, Viale Risorgimento 2, 40136 Bologna, Italy, (39+51) 644-3471.

September 26-October 2: **12th International Symposium of the Bioelectrochemical Society,** Seville, Spain. Contact: Dr. Martin Blank, see September 18-23, above.

October 2-5: **Work With Display Units (WWDU): 4th International Scientific Conference,** University of Milan, Italy. Contact: WWDU Organizing Secretariat, Via Scheiwiller 1, I-20139 Milan, Italy, (39+2) 55210523.

October 9-14: **186th Meeting of the Electrochemical Society,** Fontainebleau Hilton, Miami Beach, FL. Contact: Brian Rounsavill, see May 22-27, above.

October 12-15: **14th Annual Meeting of the Society for Physical Regulation in Biology and Medicine,** Hyatt Regency, Crystal City, VA. The society was formerly called BRAGS; see p.16. Contact: Society for Physical Regulation in Biology and Medicine, PO Box 64, Dresher, PA 19025, (215) 659-5180.

November 3-6: **16th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBS),** Baltimore, MD. Contact: IEEE/EMBS Conference Management Office, 2603 Main St., Suite 826, Irvine, CA 92714, (714) 752-8205.

November 8-10: **1994 JINA International Symposium on Antennas,** Nice, France. Contact: Secretariat JINA 94, CNET-PAB Centre de La Turbie, 06320 La Turbie, France, (33+93) 410229.

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

UPDATES

CANCER CLUSTERS

St. Louis Newsroom Cancer Study...NIOSH will send a three-person team to investigate a cancer cluster at the *St. Louis Post-Dispatch* in Missouri on December 13. There was some question as to whether the agency would go because it had not confirmed that the cancers were primary brain tumors—that is, cancer that originates in the brain (see *MWN,* S/O93). In fact, NIOSH recently discovered that at least four of the seven people at the paper diagnosed with brain cancer since 1982 did not have primary brain tumors, which lessens the likelihood that the tumors are related to a common source of exposure, according to NIOSH's Dr. Bruce Bernard, who will lead the investigation. But he said that an on-site visit is important, in part to give the paper's labor and management representatives—who have disagreed about how to approach the problem—a chance to "get the issue out and onto the table." Bernard said that he is dubious about finding a cause for the cluster because the study population is so small and because brain tumors can take decades to emerge, making it very difficult to trace the source. Gene Moss, who has done past NIOSH EMF surveys (see *MWN,* M/A93), will take readings at the *Post-Dispatch,* Bernard said.

GOVERNMENT

Senator Protests EPA Cutbacks... In a letter to EPA Administrator Carol Browner, Sen. Joseph Lieberman (D-CT) urged the agency not to phase out its work on NIER and to issue exposure guidelines for RF/MW radiation. Under its proposed fiscal year 1995 budget, EPA's Office of Radiation and Indoor Air would eliminate all but one staff position for NIER programs (see *MWN,* J/A93). Lieberman stressed that this "would be inconsistent with the agency's responsibility to provide full protection of public health and the environment." He was particularly concerned that

the cutbacks would mean that the agency would fail to issue RF/MW radiation exposure limits. EPA first announced its intention to issue such rules in the 1970s but has never done so, despite the urgings of its own Scientific Advisory Board (SAB) (see *MWN*, J/A91). "Such a failure would disregard the concerns of the public, the recommendation of the SAB, and EPA's own prior conclusions," Lieberman wrote. Lieberman, the chairman of the consumer and environmental affairs subcommittee of the Committee on Governmental Affairs, held a hearing on the possible links between traffic radar and cancer in August 1992 (see *MWN*, S/O92).

MEDICAL DEVICES

Detailed EMI Reports... An FDA scientist has catalogued a long list of examples of how EMI can disrupt or disable medical devices, including critical monitoring and life-support equipment. "Deaths and serious injuries have occurred as a result of electronic medical device performance degradation that was caused by EMI," writes Jeffrey Silberberg of FDA's Center for Devices and Radiological Health in Rockville, MD. In the fall issue of *Compliance Engineering*, he presents brief accounts of more than 100 EMI episodes, ranging from the curious to the tragic. Some involve one piece of hospital equipment interfering with another—an infusion pump affecting patient monitors, for example, or a muscle stimulator causing a chiropractic table to move unexpectedly, resulting in an electric shock to the patient. Others concern transmitters such as cellular phones and two-way radios disrupting the operation of incubators, fetal heart rate detectors, dialysis machines and ventilators. "I think we're looking at the tip of the iceberg," Silberberg said in a telephone interview. While medical device manufacturers are required to report malfunctions to the FDA, he explained, they do not always know that a particular problem could be due to EMI. As awareness of the issue has grown, he said, the number of EMI reports has increased. What can be done to control medical device EMI? In hospitals, he suggests, "Prohibiting sources such as cellular phones, walkie-talkies, and rooftop commercial transmitters from certain areas or from the entire facility should be considered." The FDA has, in recent years, enhanced its in-house testing capabilities and devoted "increased emphasis and effort" to the problem. And manufacturers are being told to do more rigorous EMC testing. The FDA has given special attention to effects on three devices: apnea monitors (see *MWN*, J/A91 and N/D91); anesthetic gas monitors used in surgery rooms; and electric wheelchairs (see *MWN*, J/A 93). For the wheelchairs, Silberberg presents more details than have been available before. In June 1992, he explains, a quality assurance manager who had worked for a major wheelchair manufacturer contacted the FDA and "reported that in his previous position he had received reports of powered wheelchairs driving off curbs and piers unintentionally when a police or fire vehicle, harbor patrol boat, or CB or amateur radio was in the vicinity." With the growth in wireless communications products, Silberberg notes, "The ambient electromagnetic environment continues to intensify." He points out, for example, that cellular phones operating on the new European GSM standard "are expected to produce a 200 Hz tone in hearing aids at a distance of up to 30 meters." At close range, the noise could be as loud as 130 dBA. (See also, *MWN*, S/O85 for a report on cochlear implants and EMI; and see *MWN*, N/D85 for an earlier report on FDA's concern over medical-device EMI.) *Compliance Engineering* is published in Boxborough, MA.

MEETINGS

CTIA Symposium... Organizers of the Cellular Telecommunications Industry Association's (CTIA) health research initiative are expanding their effort to gather the views of a broad range of experts from government, industry and academia. After government representatives boycotted a CTIA session in September, Dr. George Carlo, head of the advisory group that CTIA has established to oversee the $15 to $25 million research program, scheduled an additional meeting for October 27 in Washington that FDA scientists, among others, would attend (see *MWN*, S/O93). That symposium was then delayed until December 14-15. "The focus of this meeting is on possible cancer causation," said Michael Volpe, a spokesman for Carlo. "It will complement the previous meetings on general research needs [in September] and on dosimetry [held in Chicago last July]," he added. Though relations between CTIA and the FDA have been strained in recent months (see *MWN*, J/A93), Dr. Mays Swicord of FDA's Center for Devices and Radiological Health in Rockville, MD, has agreed to chair the first day's discussions. Carlo will lead the second day of the meeting. Federal Focus Inc., a nonprofit group based in Washington, has been brought in to help run the symposium. As with the September meeting, Carlo's group will not disclose who has been invited to the meeting and has barred the media from attending. Carlo had hoped to have his research agenda completed in November, but it has not yet been released. He has, however, scheduled a press conference for December 13 to announce new research projects.

OCCUPATIONAL HEALTH

RF Mitigating Suits... While protective clothing has gained acceptance for reducing MW radiation exposures, Maxwell Safety Products Ltd. of Smithtown, NY, is now selling a material that can also be used in lower-frequency, RF radiation environments —such as radio and television broadcast towers. Joe Amato, Maxwell's vice president for marketing, said he is trying to "create a market" in the broadcast industry for his Naptex fabric, which is made in Germany. "It is the only way to take care of induced current problems," Amato said. To support his position, he points to a recent study by Richard Olsen and Barry Van Matre at the Naval Aerospace Medical Research Laboratory in Pensacola, FL, which Maxwell sponsored. Olsen and Van Matre exposed a human-size model designed for measuring RF exposures to radiation at four frequencies between 2 and 400 MHz, taking measurements with and without the Naptex suit. They found significant SAR reductions. At 29.9 MHz, for example, an average ankle SAR of 15.5 W/Kg without any protection was reduced to 0.7 W/Kg when the model was placed in a full Naptex suit and overshoes. "The full protective ensemble changed out-of-compliance and borderline exposure situations into ones that were not only in compliance but also with a wide margin of

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safety," Olsen and Van Matre wrote. Richard Tell, a consultant based in Las Vegas, who has performed his own tests of Naptex, said the material "could provide as much as a 20 dB reduction" in RF fields—a reduction by a factor of 100. "I think it represents a good mitigation approach for people who must, from time to time, be in strong RF fields," he told *Microwave News*. Amato noted that Naptex is also effective at MW frequencies. Previous papers on protective clothing have noted the need for materials capable of mitigating radiation below MW frequencies (see *MWN*, N/D87). Copies of Olsen and Van Matre's report, *Measurements of Ankle SAR and Body-to-Ground Current in a Suit-Protected Human Model for Near-Field Exposures, 2-400 Hz*, are available from: Maxwell Safety, 20 Gilbert Ave., Smithtown, NY 11787, (516) 366-2411.

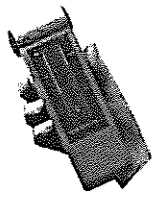
PEOPLE

Dr. **Genevieve Matanoski** of the Johns Hopkins University School of Hygiene and Public Health has been appointed to a two-year term as the chair of EPA's Science Advisory Board (SAB) Executive Committee. In 1991, Matanoski was the head of the subcommittee that reviewed EPA's cancer report on EMFs and RF radiation. She was later named the chair of SAB's Radiation Advisory Committee....Dr. **Cletus Kanavy**, the chief of the biological effects group at the Phillips Laboratory's Electromagnetic Effects Division at Kirtland Air Force Base, NM, died of acute renal failure on October 14 (see *MWN*, S/O93)....Dr. **Stuart Harvey** and **Murray Walsh** have left Ontario Hydro and started up EMF-RAD, a consulting firm based in Brampton, Canada, outside Toronto. Harvey said that they will provide instrumentation, measurement and mitigation services. ...Dr. **Asher Sheppard** has asked to be relieved as the associate editor for EMF experiments and applications of *Bioelectromagnetics* because of the time pressures of his new consulting business in Redlands, CA. He is being replaced by Dr. **Larry Anderson** of the Battelle Pacific Northwest Labs....**Paul Brodeur** of *The New Yorker* and Dr. **Louis Slesin** of *Microwave News* have each received the Robert Carl Strom Humanitarian Award. The presentations were made at the *3rd Annual National EMR Alliance Conference* in Pittsburgh, November 12-13. The award is presented each year by the Strom Foundation to people or organizations that have increased public awareness of EMF health hazards. The foundation was set up with money Strom received from Boeing to settle his claim that exposure to EMP caused his leukemia (see *MWN*, S/O90). Past winners were Drs. Sam Milham and Abe Liboff.

PROFESSIONAL SOCIETIES

New Names for Old Organizations... In October, the Bioelectrical Repair and Growth Society (BRAGS) changed its name to the Society for Physical Regulation in Biology and Medicine. The new name is designed to reflect the changing interests of the group and to attract a wider range of members, said Bruce McLeod of Montana State University in Bozeman, a past president of the society. "Originally the main focus was on orthopedic applications, such as bone repair, but, as the organization has grown, members have branched out into other fields, such as

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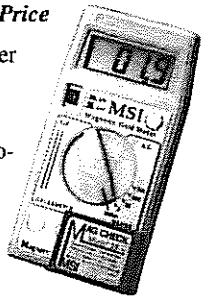
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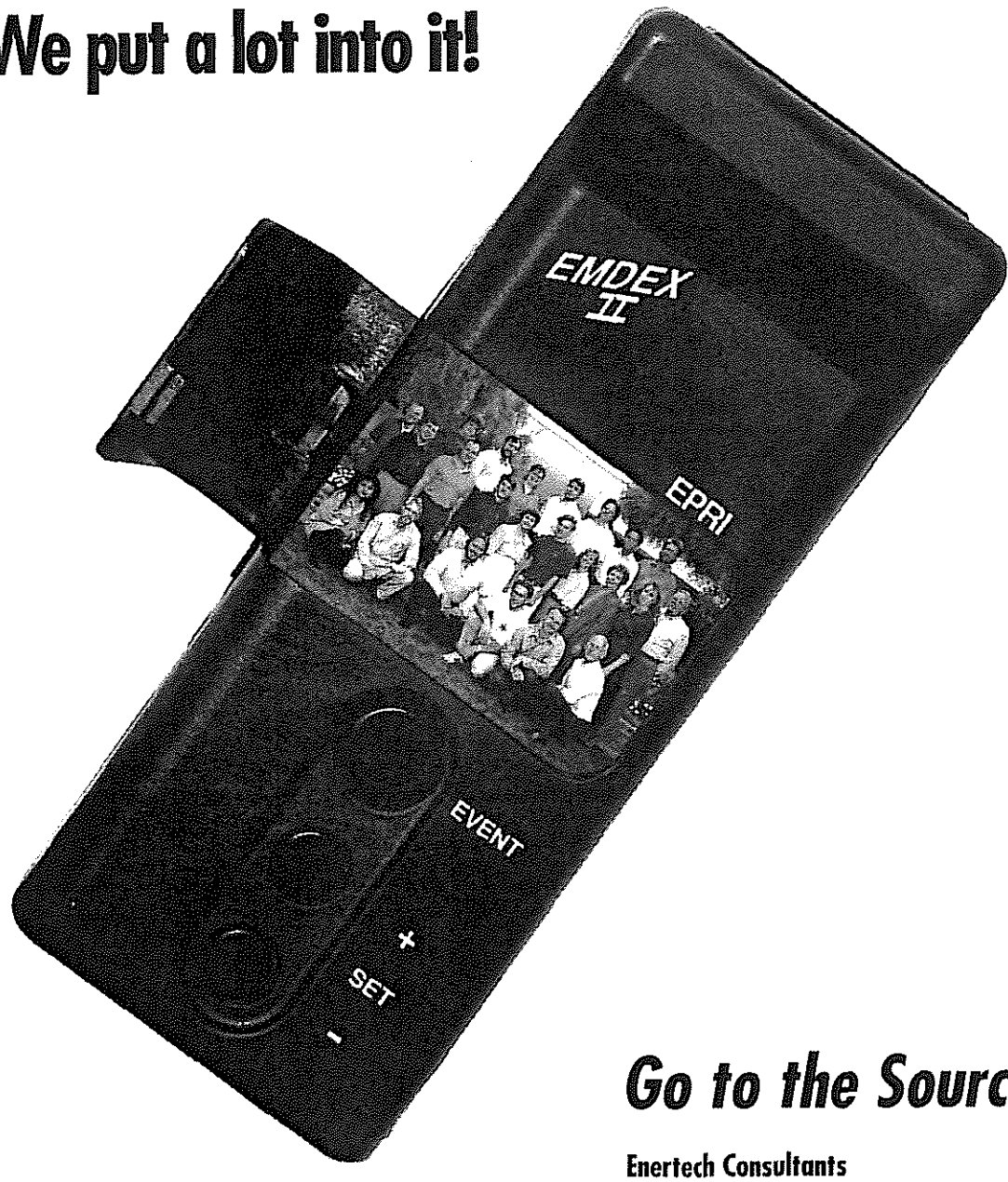
nerve regeneration and tissue repair," he explained. The society's 14th annual meeting will be held next October....The Society of Magnetic Resonance in Medicine (SMRM) and the Society for Magnetic Resonance Imaging (SMRI) are joining to become the Society of Magnetic Resonance (SMR). The merger will go into effect on January 1, 1994, with the election of new officers to take place soon afterwards (there may also be a vote to change the society's new name). "The impetus behind the merger was that the two societies were becoming closer together in terms of interests and memberships," said Jane Tiemann, executive director of SMRM. "It made more sense to become one group rather than work against each other." Next year SMR will have two meetings—the first, organized by SMRI, will be held in March, and the second, organized by SMRM, will be held in August. Eventually there will only be one annual meeting, Tiemann said. Initially, SMR will have two offices—SMRM's in Berkeley, CA, and SMRI's in Chicago. Members will be free to form local chapters and study groups on specific subtopics, said Kristen Coe, executive director of SMRI. For details on all three meetings, see pp.13-14.

TAOS HUM

Is It Electromagnetic Noise?... Those who sense the annoying low frequency "sound" that has come to be known as the Taos hum may in fact be "responding to the growing volume of electromagnetic noise" in the environment, according to the scientific team that was assembled last spring to investigate the phenomenon. Extensive measurements of acoustic, seismic and electromagnetic signals, taken at several locations around Taos, NM, "did not detect the source of the hum," the scientists concluded in an August 23 report. But they added: "The team did not eliminate the possibility that some people could be unusually sensitive to radiofrequency or microwave radiation, particularly if modulated...by frequencies below 100 Hz." This hypothesis is "soft," the group's leader, Dr. Joe Mullins of the University of New Mexico (UNM), Albuquerque, admitted in an interview with *Microwave News.* But he added that research on human perception of electromagnetic radiation is inadequate to dismiss the idea. The investigators—from UNM, Sandia National Labs, Los Alamos National Labs and Phillips Lab at Kirtland Air Force Base—spent a week in late May collecting data at sites where the hum is said to be loudest (see *MWN,* M/J93). At one location, they did detect unusually strong signals at 60 Hz and higher harmonics coming from power lines. "It was tantalizing," Mullins said, but they ultimately dismissed this finding. These signals were not present at all locations where the hum is perceivable, Mullins explained, and an audio signal they created, with frequencies and waveforms similar to the power line harmonics, did not sound right to those who hear the hum. "At this point, the focus must be on people's ability to perceive this phenomenon," Mullins said. In the coming months, UNM's Dr. Jim Kelly will be studying the hearing of those who detect the hum. Copies of *Taos Hum Investigation: Informal Report,* August 23, 1993, are available from: Sherry Robinson, UNM Public Affairs, 1805 Roma, NE, Albuquerque, NM 87131, (505) 277-5813. A more detailed report, with all of the data that were collected, has been prepared at Sandia.

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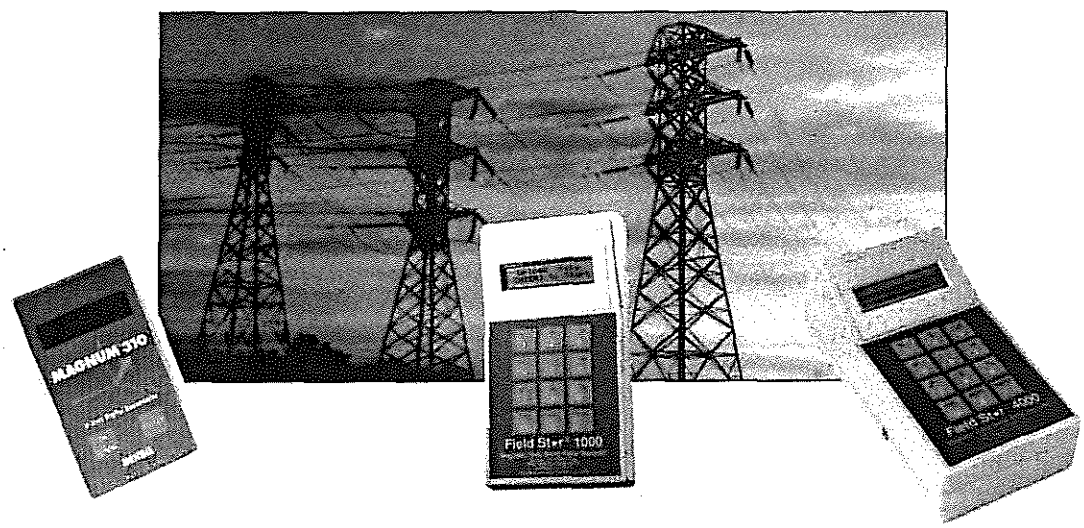
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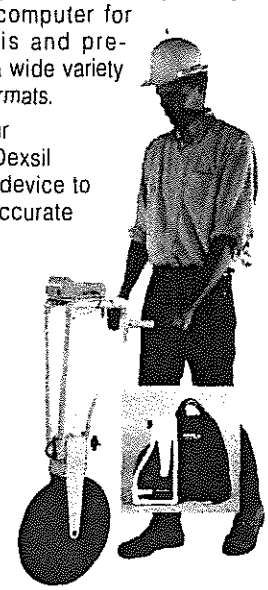
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Microwaves Break DNA in Brain; Cellular Phone Industry Skeptical

Low-level microwave radiation can cause DNA breaks in the brains of experimental animals, according to studies carried out in the U.S. and in India. The new results, which have attracted a lot of interest within the cellular phone industry, suggest that microwaves could act as a cancer-causing agent.

Drs. Henry Lai and Narendra Singh of the University of Washington, Seattle, have found that a single two-hour exposure to 2.45 GHz radiation at levels currently believed to be safe can increase the number of single-strand breaks in the DNA of the brain cells of rats. "DNA damage is related to the initiation of cancer—if there is an error in the repair process, it could lead to a problem," Lai told *Microwave News*.

"We have a long way to go before we can reach any definitive conclusions," Lai added, pointing out that, "DNA breaks may stimulate DNA repair mechanisms, which could in fact have a beneficial effect." The Lai–Singh paper has been accepted for publication in *Bioelectromagnetics*. It should appear by the spring, according to Dr. Ben Greenebaum, the editor of the journal. (See p.12 for details of the study.)

A second animal study, by a group led by Dr. Soma Sarkar of the Institute of Nuclear Medicine and Allied Sciences in New Delhi, India, found that the DNA in the brains and testes of mice had undergone "rearrangement" following microwave exposure at the same frequency and approximately the same intensity as in the Lai–Singh study. Sarkar and coworkers concluded that a reevaluation of the mutagenic potential of microwave radiation "seems imperative." Sarkar's results were published in *Mutation*

(continued on p.11)

Hydro-Québec Bars Further Work on Transient Data by McGill University

Hydro-Québec (HQ), a Canadian electric utility, is refusing to allow researchers at McGill University the opportunity to analyze further the data collected in the $3 million Canadian–French epidemiological study released earlier this year (see *MWN*, M/A94). "I can't use the data anymore," said Dr. Gilles Thériault, who led the research project and is the chair of the Department of Occupational Health at McGill University's medical school in Montreal. "It's in the contract that the data belong to the utility and so I can't use them."

Dr. Claude Cardinal, HQ's electromagnetic field (EMF) program manager, confirmed that the utility is barring further access to the data. "All the data belong to the utilities and there is no mandate to start a new analysis," Cardinal told *Microwave News*. Dr. Michel Plante, an HQ medical adviser in Montreal who has been a utility liaison to the McGill team, said: "We

(continued on p.5)

« Power Line Talk »

Almost nine months after President **Bill Clinton** said he would ask the **EPA** to report to him on EMF health risks, the White House has not responded with any formal statement—and don't expect one. Last March, during an **ABC News** special featuring schoolchildren at the White House, Clinton fielded a question about whether EMF exposures could be lowered to help prevent childhood cancer. He responded that EPA Administrator Carol Browner would review this issue and "make a report to me in the near future to try to make a decision about what we should do" (see *MWN,* M/A94). The report from the EPA, according to agency staffers, described the work the agency planned to pursue as part of its revived NIER program (see *MWN,* M/A94 and S/O94). "The White House seemed to feel that the stepped-up effort the EPA has undertaken, together with the EMF RAPID program [the $65 million federal research program], formed a sensible response to the issue," explained **Eugene Durman**, deputy director of EPA's Office of Radiation and Indoor Air in Washington. Officials in the White House Office of Environmental Policy did not respond to repeated questions from *Microwave News* on whether any other follow-up was planned. **Julie Larm**, whose son Kevin has leukemia and whose son Patrick posed the EMF question to the President, said she was disappointed that the White House had not done more, "especially since children's lives are at stake." Several days after the question-and-answer session, the President met privately with Julie Larm, who is a cofounder of Omaha Parents for the Prevention of Cancer, and her two sons. She asked for an executive order establishing a buffer zone between EMF sources such as power lines and substations and any new homes, schools or hospitals. "I was hoping they would move on it, or at least do something," she said.

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Dr. **David Savitz**'s epidemiological study of cancer among utility workers will be published in the January 15, 1995, issue of the *American Journal of Epidemiology*. No details will be available until then, Savitz said.

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The **DOE** bioeffects research program, apparently sentenced to oblivion by the U.S. Senate (see *MWN,* M/A94 and S/O94), is having, if possible, even more troubles. **Marvin Gunn** was recently named director of the Office of Management and Resources, leaving an empty slot at the helm of the research program that he has been running. It is not clear who will take over and whether the replacement will have the political clout to convince the Congress to keep the DOE effort going beyond the end of the 1995 fiscal year, the current deadline. Researchers with DOE contracts, already worried about their future, were not pleased to find out at their annual meeting in Albuquerque, NM, in early November that, due to a planning snafu, they would have to go to Washington at the end of the month for peer review by a group of outside experts, most of whom were also in Albuquerque. To make matters worse, none of the contractors can get any of their 1995 money until the future of the DOE program is decided. And finally, a report that was to serve as the rationale for the program and which was supposed to be released in Albuquerque is still unfinished. Some staffers say it is being edited; others say that the delays are being caused by undue striving to satisfy the utilities and other concerned parties.

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The **EPA**'s new toll-free EMF hot line is getting mixed reviews. Two major utilities—**United Illuminating Co.** (UI), based in New Haven, CT, and **San Diego Gas & Electric Co.** (SDG&E)—are objecting to operators' "ill-informed" and "evasive" responses to random calls made by their employees. United Illuminating prepared a list of answers that it thought were off-base, including one suggestion that utilities probably are biased when measuring EMFs near transmission lines because of customer concerns about property devaluation. UI Environmental Issues and Audit Manager Kathleen Shanley also said hot-line staff members had no knowledge about the Swedish EMF–cancer study and did not know what the EMF RAPID program was. At SDG&E, EMF Project Manager Angela Dawson encountered similar responses with her telephone call, but noted that the hot-line operator handled a question about safe magnetic field levels well by explaining that "no safe or unsafe levels have been established." The EPA is taking the criticism seriously. "We decided to go back and really reexamine what the hot line is about and how we can better serve the public, while staying within the technical and training capabilities of our contractor," said **Dennis O'Connor**, a policy analyst at EPA's Office of Radiation and Indoor Air. O'Connor said there already has been a change in procedures: Hot-line operators will offer to send two question-and-answer booklets to callers, one from the Bonneville Power Administration (see *MWN,* M/A94), and another from the EMF RAPID program. "Now that we have follow-up materials, they will be a principal mechanism by which we inform people. So instead of a 20-minute free-ranging phone call, it will be a short, five-minute call to deal with immediate concerns, and then we'll send information," O'Connor said. From its launch in mid-May until September 30, the hot line had received 900 calls in which people mentioned 1,500 concerns in a variety of categories, including: health effects (22%), regulations and acceptable levels of EMFs (19%), power lines and wiring (18%), effects on real estate values (14%) and appliances and other equipment (6%), according to O'Connor. EPA's hot-line number is (800) EMF-2383. It is staffed weekdays from 9 am to 5 pm, eastern time....People seeking information about EMFs have another option. They can call the **NIEHS Enviro-Health Clearinghouse**'s number: (800) NIEHS-94, staffed weekdays from 9 am to 8 pm, eastern time.

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Utilities have been receiving a large number of customer requests in recent years to survey EMFs in their homes and their children's schools and on their property. In responding

to the demand, the measurements have been carried out mostly on an ad hoc basis, varying widely in their sophistication. Now, under the sponsorship of three Washington-based utility trade associations—the American Public Power Association (**APPA**), the Edison Electric Institute (**EEI**) and the National Rural Electric Cooperative Association (**NRECA**)—the **National EMF Measurement Protocol Group** (NEMPG) has developed its own procedure: *Power Frequency Magnetic Fields: A Protocol for Conducting Spot Measurements in Residential Settings*. "This protocol is *not* intended to be a standard of any sort," the NEMPG notes in the 24-page booklet, but is offered for voluntary use by utilities who may not have the in-house technical staff and for those who want their procedures to be consistent with others. The two-part booklet provides instructions, background information and sample data forms. The NEMPG is chaired by **Kate Brown Maracas**, supervisor of environmental affairs at the Salt River Project in Phoenix, who said, "The protocol will help customers put EMF issues into perspective through learning about what the sources of EMFs are and the relative levels of EMFs from those sources." Maracas and three others—Mike Rossler, EEI's manager of environmental programs, Madalyn Cafruny, APPA's director of communications, and Paul Wesslund, NRECA's associate director for communications services—synthesized data, assimilated comments and put together the final draft, Rossler said. "I think the value of the protocol is that it will ensure consistency among utilities throughout the U.S. in measuring magnetic fields," he added. Copies are available to members of the three trade associations for $30 and to nonmembers for $60 from: APPA, (202) 467-2926; EEI, (800) EEI-5453; or NRECA, (202) 857-9590.

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EPRI and the **EEI** are sponsoring a national teleconference on EMF occupational health on February 6, 1995. **Jack Sahl** of Southern California Edison Co., Dr. **David Savitz** of the University of North Carolina, Chapel Hill, and Dr. **Gilles Thériault** of McGill University in Montreal, each of whom has recently completed an epidemiological study of utility employees, will be interviewed by Lee McEachern, a science reporter, and **Martha McNeil**, EMF issue manager at Pacific Gas & Electric Co. Then, the three epidemiologists will answer questions from those tuning in. The two-hour event is open only to electric utilities and related organizations—and only those with deep pockets. The cost is $1400 per site and $7000 for a company that wishes to redistribute the program on its own network. For more information on *Occupational Health & Electric Utility Workers: An Update on EMF Research,* contact: Mind•Link International Inc., 18 Crow Canyon Court, San Ramon, CA 94583, (510) 838-2654.

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The families of three northeast London children have lost their bid to force Michael Heseltine, the U.K. Secretary of State for Trade and Industry, to limit EMFs from six 275 kV underground power lines that run through their neighborhood. **Martyn Day**, an attorney with Leigh, Day & Co. in London, had argued that Heseltine was obliged, under the "precautionary principle" of the Maastricht Treaty, to ensure that magnetic fields in houses adjacent to the lines did not exceed 2 mG. The treaty, which created a European Union giving common citizenship to all European Community members, was signed by the U.K. in 1992. The High Court ruled that Heseltine does not have to order the National Grid Co. to control EMFs unless there is a significant health risk, according to the October 4 *Independent,* a national newspaper. Day had originally planned to bring suit on behalf of 50 children from northeast London and had obtained legal aid from the government to do so (see *MWN,* M/A94). Day told *Microwave News* that he trimmed the number to three "representative actions" at the suggestion of the Legal Aid Board. He is now asking the Court of Appeal in London to refer the case to the European Court of Justice in Luxembourg. If the case is decided in his clients' favor, "it would have an implication not just for Britain but for all of the European member states," Day said. There is little official support in the U.K. for the proposition that there are health risks associated with EMFs. Earlier this year, the National Radiological Protection Board updated a 1992 report and concluded that "there is no persuasive biological evidence that ELF [EMFs] can influence any of the accepted stages in carcinogenesis" (see *MWN,* J/A94). And the Institution of Electrical Engineers (IEE), in a June 1994 supplement to its 1992 report, *The Possible Biological Effects of Low-Frequency Electromagnetic Fields,* wrote that epidemiological evidence remains "inconclusive" and animal and cellular studies "have failed to elucidate any mechanism or consistent trend in results." This does not differ significantly from the IEE's earlier findings (see *MWN,* J/F92). Nevertheless, EMF lawsuits are of increasing concern in the U.K., as evidenced by an October 27 conference in London, chaired by Sir **Richard Doll** of the Imperial Cancer Research Fund in Oxford. Addressing both scientific and legal concerns, featured speakers included Dr. **Ross Adey** of the VA Hospital in Loma Linda, CA, Dr. **Gilles Thériault**, Dr. **Bengt Knave** of Sweden's National Institute of Occupational Health in Solna and **Mark Warnquist** of the Denver law firm of LeBoeuf, Lamb, Greene & MacRae. In its coverage of the conference, the November 6 *Sunday Telegraph,* noting the large number of lawsuits in the U.S. dealing with EMFs, had a last word on the Day case: "Here in Britain, however, we have no need of such legal nannying....While the judge [in the Day case] accepted the possibility of a hazard, he declared that [Heseltine] was under no legal obligation to take any notice of it."

Transients and Lung Cancer: A "Strong" Association and a "Remarkable" Exposure–Response

The long-awaited results of the McGill University analysis of high frequency transients (HFTs) show up to a tenfold increased risk of developing lung cancer among highly exposed utility workers and a "very clear" exposure–response relationship.

The epidemiological study of electric utility workers at Hydro-Québec (HQ) and Electricité de France (EDF) found that the 10% most exposed to HFTs had a statistically significant greater-than-threefold increased risk of developing lung cancer. Most of the highly exposed workers—specifically linemen and splicers—were at HQ. When the analysis was limited to this group, the risk was 6.67 times greater than expected and rose to 9.87 times greater than expected when adjusted for smoking, socioeconomic status and other occupational exposures—both were highly significant findings. There was no association for the French workers, which the researchers explained "by the much lower levels of exposure [to HFTs] at EDF."

The most highly exposed workers, at both HQ and EDF, who were first employed more than 20 years prior to diagnosis, had a significant sevenfold increased risk of lung cancer.

McGill Abstract

"The authors report the association between exposure to pulsed electromagnetic fields (PEMFs) [also called high frequency transients] and cancer in a nested case–control study of electric utility workers in Québec, Canada (follow-up, 1970-1988), and France (follow-up, 1978-1989), among whom 2,679 cases of cancer were identified. Exposures were assessed through a job-exposure matrix based on about 1,000 person-weeks of measurements from exposure meters worn by workers. Exposures were considerably higher in Québec than in France. No association was found between PEMFs and cancers previously suspected of association with magnetic fields (leukemia, other hematopoietic cancers, brain cancer, or melanoma). However, there was a clear association between cumulative exposure to PEMFs and lung cancer, with odds ratios rising to 3.11 (95% confidence interval (CI) 1.60-6.04) in the highest exposure group (84 cases). This association was largely confined to Québec, where there was a monotonic exposure–response relation with an odds ratio of 6.67 (95% CI 2.68-16.57) in the highest exposure group (32 cases). The association is substantial and was not explained by smoking or other occupational exposures. However, several factors limit the strength of the evidence for a causal relation: lack of precision in what the meters measured; little previous evidence for this association; and no elevated risk for lung cancer in the utility workers overall in comparison with the general population." Benedict Armstrong et al., "Association Between Exposure to Pulsed Electromagnetic Fields and Cancer in Electric Utility Workers in Québec, Canada, and France," *American Journal of Epidemiology, 140,* pp.805-820, November 1, 1994.

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The new results, which appear in the November 1 issue of the *American Journal of Epidemiology,* are sure to focus more attention on transient EMFs, which have already emerged as a hot new research area (see *MWN,* M/A94). The abstract of the paper appears below.

In a November 10 presentation at the annual review of EMF research, held in Albuquerque, NM, McGill's Dr. Gilles Thériault called the HFT–lung cancer link "an unusually strong association," which he had seen only once before—for bladder cancer in the aluminum smelting industry. Throughout his talk, Thériault repeatedly called the exposure–response relationship "remarkable" (see table on p.5). He noted that, "It is very unlikely that our results can be explained by confounders." McGill University is in Montreal, Canada.

Last March, when Thériault announced the first set of results of his study of Canadian and French utility workers that linked 50/60 Hz magnetic fields to leukemia and brain cancer, some observers downplayed them because of a lack of an exposure–response relationship (see *MWN,* M/A94).

Following Thériault's presentation in Albuquerque, many other epidemiologists said they found the observed exposure–response relationship compelling. "It's astonishing," said Dr. Nancy Wertheimer. Dr. Tore Tynes of the Cancer Registry of Norway in Oslo called it a "very dramatic trend," and Dr. Anders Ahlbom of the Karolinska Institute in Stockholm, Sweden, said that he was "intrigued" by the lung cancer association and that he was "very impressed with the data."

Utility representatives were more cautious, however. Dr. Michel Plante, an HQ medical adviser, told *Microwave News* that, "It's most likely that this is a random result or the direct result of smoking," although he did concede that, "It's quite rare to see this kind of dose–response." The Electric Power Research Institute (EPRI) in Palo Alto, CA, is also not ready to discount "residual confounding by cigarette smoking," but allowed, in a prepared statement, that "the suggestion of an association with EMF exposure needs to be taken seriously."

The Edison Electric Institute, based in Washington, cited the fact that "smoking data was incomplete across the study population." Indeed, no data on smoking habits by the French workers were available and some were missing for the HQ population.

The McGill researchers cautioned that uncertainties about what types of exposures were actually measured, little past indication of an EMF–lung cancer link and the absence of an overall elevated lung cancer risk among utility workers all act to limit the argument for a causal link. "It was an unexpected finding of a previously unsuspected association," McGill's Dr. Ben Armstrong, the lead author of the new paper, told *Microwave News*. He acknowledged that the new result could be a chance finding.

EPRI noted that, "Perhaps the most serious limitation of the interpretation of the results is the incomplete (and apparently incorrect) characterization of the [Positron dosimeter's]

Adjusted† Odds Ratios (ORs) and Confidence Intervals (CIs) for Lung Cancer Among Hydro-Québec Workers by Cumulative Exposure to High Frequency Transients (HFTs)

Exposure Group (Index)*	*No. of Cases/ Controls*	*OR (95% CI)*
0-0.049	41/57	1.00
0.05-0.099	2/0	
0.10-0.24	2/3	
0.25-0.49	0/5	
0.5-0.99	5/11	1.84 (0.33-10.4)
1.0-2.4	7/25	0.62 (0.19-2.16)
2.5-4.9	36/20	5.64 (1.51-21.0)
5.0-9.9	34/28	5.09 (1.26-20.6)
10.0-24.9	62/48	7.13 (1.85-27.7)
≥25.0	11/3	16.6 (2.58-107)

†Adjusted for socioeconomic status. *A cumulative weighted index: the product of HFT intensity and number of years of exposure.

performance" (see p.6).

Nevertheless, the Canadian–French team argued that, "The association observed met several criteria considered suggestive of causality: It was strong; it was largely specific to lung cancer; adjusting for potential confounders, including smoking (at HQ), did not essentially change it; a very clear monotonic exposure–response relation was present; and the association was independent of the particular summary of [HFT] exposure used."

Thériault told *Microwave News* that the HFT results are "the first epidemiological data to support the promotion hypothesis," explaining that the transients may be interacting with the carcinogenic chemicals in cigarette smoke. Indeed, Thériault and colleagues also found a weak link to stomach cancer. In his presentation in Albuquerque, Thériault said that this result supports the lung cancer finding: "You swallow the chemical and you get the same phenomenon in the GI tract, but at a lower rate." He added that the fact that there was no generalized increase in lung cancer among the utility workers as compared to the general population could indicate that only a small proportion of the HQ work force is highly exposed to HFTs.

In support of their findings, the Canadian–French researchers point to the similarities between HFTs and pulsed electromagnetic fields (PEMFs), which are used to heal nonunion fractures and which have been associated with a large number of biological effects. In addition, they cite studies showing chromosomal effects among substation workers (see *MWN,* J/F85).

In 1989, Dr. Genevieve Matanoski of the Johns Hopkins University School of Hygiene and Public Health in Baltimore reported an increased risk of lung cancer, as well as many other types of cancer, among New York Telephone Co. workers (see *MWN,* N/D89).

have a contract problem that has to be solved and there will be no new mandate until it is solved."

HQ officials are furious about the November release of a paper by the McGill team that shows an up-to-tenfold increased risk of lung cancer for exposures to high frequency transients (HFTs) (see p.4). "We never planned to collect the HFT data and there is no mention of HFTs in the specifications of the study," Cardinal said. Plante argued that by publishing the HFT results, Thériault had violated an agreement with the utilities. Thériault countered that, although he was under intense pressure not to work on transients, "It has always been clear that I would analyze the HFT data and that if I found something, I would inform everybody."

No lawsuits have yet been filed by either side, both Thériault and Plante said. But Thériault did say that, "Both parties have consulted lawyers." Plante said that talks to resolve the disagreement are continuing between HQ and McGill.

Thériault told *Microwave News* that he felt a professional obligation to release the transient findings because of their potential significance. "The HFT observation deserves the attention of my scientific colleagues." He said that, "This is the first epidemiological data to support the promotion hypothesis," referring to the possible synergy between HFTs and the carcinogenic chemicals in cigarette smoke. "My interpretation is that the HFT data may turn out not to be important, but, at this point, we don't know—we *should* find out."

In its paper, published in the *American Journal of Epidemiology,* the McGill team explained that if the association between lung cancer and HFTs is causal, it "would have substantial implications for public health." Dr. Anders Ahlbom of the Karolinska Institute in Stockholm, Sweden, echoed this concern: "Clearly, if the HFT–cancer link is true, it makes a big difference to public health because lung cancer is a very common disease."

In addition to measuring 50/60 Hz EMFs, the Positron dosimeter used in the study also measured HFTs. The meter was originally designed by Dr. Paul Héroux while he was working at IREQ, the research arm of HQ. Héroux is now at McGill and collaborates with Thériault. "HQ sponsored the development of the meter and at the beginning they were very pleased to have the HFT data," Thériault said. "But in the middle of the study they did not want to use it anymore."

News of HQ's decision to block further analysis of the HFT data stunned many of those at the Department of Energy's (DOE) annual EMF research review, held in Albuquerque, NM, November 7-10, though it was never formally acknowledged. Most of those interviewed at the meeting were incredulous that the HFT finding was not being actively pursued.

Dr. Samuel Milham, an epidemiologist and consultant based in Olympia, WA, said that the contrast between the 50/60 Hz links to brain cancer and leukemia in previous studies and the HFT link to lung cancer in the McGill study is "like black and white." "Clearly there is something different about HFT exposures that needs to be followed up."

"It's unfortunate for the sake of science," said Dr. David Savitz of the University of North Carolina, Chapel Hill. "There's a lot of work that can be done with the data." And Dr. Jerry Williams, the director of Johns Hopkins University's

Radiobiology Laboratory in Baltimore, said, "I cannot understand anyone not wanting to pursue this."

Both Dr. Nancy Wertheimer, based in Boulder, CO, and Dr. Richard Stevens of the Battelle Pacific Northwest Labs in Richland, WA, commented that limiting access to the data was "outrageous." Wertheimer said that, "The results should be out there so that others can work on them." And Stevens added that, "The utility is shooting itself in the foot. The cover-up will draw much more attention than the results." Dr. Raymond Neutra, who runs the California EMF research program (see p.8), said that, "I think it's very counterproductive if sponsors of research attempt to control its dissemination."

Dr. Kelly Gibney of BC Hydro in Burnaby, Canada, is sympathetic with HQ's view that the McGill team should not have published the HFT results as long as there is uncertainty over what the Positron dosimeter is measuring (see box at right). He said that, "The paper that has come out does not reflect good science—it's a bad piece of research." Most at the DOE meeting sided with the McGill group, however.

"It's not unusual not to know what an exposure index means," Savitz said, pointing to the wire codes developed by Wertheimer and Ed Leeper as a classic example. "The uncertainty over what it means does not negate the association," he added.

The transient analysis published by the McGill team is based only on the HFT data collected by HQ and Electricité de France. The third participating utility, Ontario Hydro (OH), did not share its HFT data with the McGill group. Dr. David Agnew, an OH senior safety scientist in Whitby, Canada, said that the HFT results "warrant further investigation" and that a proposal has been submitted to OH management to analyze its exposure data. He said that approval for this work has not yet been given.

Over a year-and-a-half ago, Dr. Ben Armstrong, who led McGill's analysis of the HFT data, submitted a proposal to HQ asking for support to do further research on what the meter is measuring and on the HFT data set in general. The request is still pending, according to HQ's Plante, who noted that the utility had decided to test the meter on its own. "This is the kind of result that must be followed up with further work," Armstrong told *Microwave News*. "I hope Hydro-Québec will agree."

Positron HFTs: Transients or RF from Mobile Radios?

What could be good news for electric utilities could spell trouble for mobile communications companies.

Three different papers presented by utility researchers at the November DOE meeting in Albuquerque showed that the Positron dosimeter used by Thériault's group to measure HFTs (as well as 50/60 Hz) responds to signals from hand-held and other types of mobile communications devices to a greater extent than previously thought.

According to its specifications, the Positron dosimeter captures radiofrequency (RF) radiation signals in the 5-20 MHz band, but all three utility groups found that it registered signals at least as high as 400 MHz. In addition, it can pick up signals that are weaker than the 200 V/m cutoff specified by the manufacturer.

"The dosimeters responded to walkie-talkies at a distance of approximately one meter and to car/truck radios up to a distance of ten meters," concluded a team from Enertech Consultants in Campbell, CA, and the Electric Power Research Institute in Palo Alto, CA. Similar findings were presented by IREQ, HQ's research arm.

A group from Ontario Hydro Technologies in Toronto, Canada, found that the Positron meter responded differently to high and low frequencies: Motorola walkie-talkies operating at 50 MHz had "little or no effect," but 461 MHz Motorola units could have "large effects."

In a fourth presentation, Dr. Paul Héroux of McGill University, who designed the prototype of the Positron dosimeter when he was at IREQ, reported "uncertainty" over the "actual contribution of radiotelephones" as compared to other sources. Nevertheless, in an interview, he maintained that, "The utilities are emphasizing the contribution of radiotelephones, but at this point nobody can be sure of the precise contribution of radios and switching transients."

Whatever HQ decides, Thériault said, "I will keep working in the field," he said. "I will find money from other sources."

Epidemiology Roundup: Leukemia, Brain and Breast Cancer

Peak Fields of Appliances May Be Critical

Battelle researchers are challenging the assumption that exposures to short, intense EMFs are unimportant. Dr. Richard Lovely of the Battelle Seattle Research Center created a stir at the 1992 annual EMF review when he announced that he and his colleagues at the Pacific Northwest Lab (PNL) in Richland, WA, had found an association between acute nonlymphocytic leukemia (ANLL) and the use of electric razors (see *MWN,* N/D92). The findings were featured by the *Wall Street Journal* the next day and were widely reported elsewhere.

Now the results have been published in the September 15 issue of the *American Journal of Epidemiology (140,* pp.510-517, 1994). Lovely and coworkers reported a nonsignificant 30% increase in ANLL among men who used electric razors as compared to those who did not, with a dose–response relationship between leukemia risk and time spent shaving. They also found that electric massage units significantly increased the risk of ANLL, while the use of electric hair dryers entailed no leukemia risk. No dose–response was seen for massage units.

Lovely told *Microwave News* that he considers the new paper "hypothesis-generating," adding that, "The peak field is an exposure parameter worthy of study."

In a separate paper *(Bioelectromagnetics, 15,* pp.439-446, 1994), another Battelle group, led by PNL's Dr. Bary Wilson, described the unique exposures from appliances. These in-

clude frequency components reaching the low MHz band, flux densities of up to 5 G and time-rates-of-change over 10^7 G/s.

Wilson and coworkers contend that the use of electric appliances does not necessarily constitute "an inconsequential contribution to the TWA [time-weighted average] metric." Someone using an electric shaver with a flux density of 1 G for three minutes, they pointed out, would have a TWA exposure similar to that of someone who was exposed to 2 mG fields for 24 hours. In a letter published in the May/June 1993 *Microwave News,* Lovely and Wilson described the drawbacks of limiting exposure metrics to TWAs.

The researchers noted that the data set—drawn from the residential adult leukemia study begun by Dr. Richard Severson, and completed by Dr. Richard Stevens, for the New York State Power Line Project (see *MWN,* N/D86 and M/J88)—has some limitations, including proxy reporting of appliance use and a small number of cases. The Electric Power Research Institute commented that an "examination of the potential influence of appliance use on adult leukemia must await a more focused and rigorous study."

No Link Between EMFs and Brain Tumors

In a study of 600 children in Los Angeles County, researchers at the University of Southern California (USC) in Los Angeles found no association between central nervous system tumors and residential exposure to magnetic fields as assessed by spot and 24-hour measurements, as well as by the Wertheimer–Leeper wire codes.

Speaking at the annual EMF research review in Albuquerque, NM, USC's Dr. Susan Preston-Martin, who led the study, spoke of a "perplexing" finding: Living in houses with underground wiring was significantly associated with a nearly fourfold increased cancer risk.

In a preliminary report, Preston-Martin wrote that, "We do not have a convincing explanation" for the link. But she noted that when she and her coworkers considered only those children who lived in their homes for at least half the time between conception and diagnosis, the association was no longer significant. She said that this "argues against a causal relationship."

Dr. Nancy Wertheimer commented at the meeting that the wire codes she developed with Ed Leeper were a "poor way to estimate high exposures" in Los Angeles, since the code was developed for Denver, where different wiring practices exist.

M.A. Stevenson of the California EMF Program (see p.8) said that the state Department of Health Services (DHS), which sponsored the study, "will wait for the final external peer review before commenting in detail." She added that the DHS continues to favor low-cost avoidance of power-frequency EMFs.

The final progress report, *Epidemiologic Study of Brain Tumors in Children and Exposure to Magnetic Fields,* is available for $10 (U.S. and Canada) or $15 (Europe), including postage, from: Copy Central, Attn: Mark, 5801 Christie Ave., Suite 100, Emeryville, CA 94608, (510) 547-5222.

USC Breast Cancer Study Ready To Begin

A five-year study of breast cancer and its possible link to EMF exposures among African-American and Latino women in Los Angeles will begin early next year with Dr. Stephanie London of USC as co-lead investigator. The effort is being funded by the National Institute of Environmental Health Sciences and the Department of Defense's Breast Cancer Research Program.

London and colleagues will use questionnaires to gather information on both residential and occupational EMF exposures, and will include questions on whether subjects are exposed to light-at-night. They will follow the protocols devised by Dr. Scott Davis of the Fred Hutchinson Cancer Research Center in Seattle and Dr. Richard Stevens of PNL for their study of breast cancer and light-at-night so that the two sets of data may later be pooled.

Other indices of EMF exposures will include: wire codes, 60 Hz levels in the home and at work and DC fields at home. London and Dr. William Kaune, who will be a consultant on exposure assessment, would also like to measure harmonics of 60 Hz fields and transients. Kaune, whose firm, EM Factors, is in Richland, WA, has designed a new transient meter and is seeking funding for its development.

Kaune's interest in the harmonics of 60 Hz fields stems in part from the "Back-to-Denver" study, in which he and his co-

EPRI Seeks Fabrics To Shield Magnetic Fields

The Electric Power Research Institute (EPRI) has contracted with SRI International in Menlo Park, CA, to develop materials for clothing that will protect wearers from 60 Hz magnetic fields. The same materials may also be used to shield sources of magnetic fields.

EPRI's Richard Lordon, based in Palo Alto, CA, told *Microwave News* that the effort is a simple application of known shielding principles—but with its own special challenges. He said SRI researchers plan to embed ferromagnetic particles in a latex material to create a fabric that will generate its own magnetic field. This field will tend to cancel the ambient fields, according to Lordon. SRI estimates that such shielding materials could attenuate applied fields up to one hundredfold.

At a presentation during the November EMF annual review in Albuquerque, NM, Lordon said that clothing made from such fabrics could do a lot to lower occupational exposures. But Dr. Luciano Zaffanella of Enertech Consultants in Lee, MA, cautioned that reduction of 60 Hz magnetic fields would also reduce the earth's magnetic field. And that might cause its own biological effects. In an interview, Zaffanella said, "I would not recommend dressing workers in such a suit." He added that he thinks it is preferable to "shield the source, not the subject."

The SRI contract began in early 1994 and runs for two years. According to the statement of work, SRI's objective is to "demonstrate feasibility." Applications will come later. "Right now, we are just trying to see if the whole thing is possible," Lordon said. He added that early results were encouraging enough to continue the project.

workers observed a relatively strong association between the 180 Hz component (the third harmonic) of the magnetic field and both wire codes and childhood cancer. Kaune presented the results at the EMF research review in Albuquerque.

London's case–control study will be part of a larger breast cancer and diet study being led by Dr. Brian Henderson, a professor of preventive medicine at USC, who will be a coinvestigator on the EMF study.

California Health Department Begins $7 Million EMF Program

The California Department of Health Services (DHS) has launched a four-year, $7 million EMF research and education program. The program, which follows closely the directive laid out last year by the California Public Utilities Commission (CPUC) (see *MWN,* N/D93), is being funded by the CPUC, with administrative and technical support from the California Public Health Foundation, a nonprofit research group.

The DHS will give top priority to EMF problems in schools. In January 1995, the agency will issue two requests for proposals (RfPs): one to assess the relative contributions of internal sources and external power lines and substations to EMF levels in schools; and a second to develop general policies for dealing with such exposures. Dr. Geraldine Lee, a DHS epidemiologist, told *Microwave News* that the state's five utilities have already begun to compile a database on how close all schools are to power lines—they will share this information with the DHS. In addition to exposure assessment and policy analysis, the DHS will also sponsor research on epidemiology and EMF mitigation.

The DHS will choose projects in consultation with the Stakeholders' Advisory Consultant Group (SACG), which was established "as a forum where concerned citizens as well as professionals can express their concerns." The DHS will have the final say, however, and there will be "no required consensus and no voting" by SACG members, according to the EMF program's ground rules, issued by the DHS.

At the first SACG meeting, held on September 30, the group suggested that a third RfP for a geographic information system on land use adjacent to power lines be rejected as too costly. In an interview, M.A. Stevenson, a public health specialist with the EMF program, said that the DHS has accepted the SACG's recommendation and withdrawn the RfP for the time being. All proposals received will be reviewed by panels of consultants assembled by the program.

Dr. Raymond Neutra, DHS's acting program chief, said that he personally favors: an epidemiological study on childhood cancer in schools near power lines; reanalyses of existing studies, particularly the Swedish study; an investigation of how average residential exposure has changed in the U.S. as electricity use has increased; an assessment of exposures in office buildings; and measurements of transients and other types of EMFs to provide a "real world" exposure assessment that lab researchers could use in their work. Neutra said that more RfPs will be issued in the future.

Florida Power Puts 500 kV Power Line on Hold

The 44-mile Lake Tarpon-Kathleen power line—which was at the center of a dispute leading to the adoption of the first power line magnetic field standards in the country—has been put on hold by the Florida Power Corporation (FPC). The St. Petersburg-based utility plans to ask the state Public Service Commission (PSC) to review the need for the project now that costs have ballooned to $80 million from the original $23 million estimate.

FPC spokesperson Karen Raihill told *Microwave News* that, "The economics for the project have gone beyond the point of being reasonable." She added that the utility still believes "this line is the best solution to averting a widespread outage."

The state Siting Board denied a permit for construction of the line in 1986 until the Department of Environmental Regulation (now the Department of Environmental Protection, or the DEP) could develop EMF standards (see *MWN,* M/A86). DEP's Buck Oven said that Lake Tarpon was "the line that gave us our rules."

Nancy Flemming of the Citizens Coalition for Responsible Power Inc. said that her Tampa-based organization, which has fought the power line for many years, was "celebrating cautiously."

The EMF program will have a separate component on public education and technical assistance. Besides publicizing research results, the unit will also respond to public concerns on disease clusters thought to be related to EMFs.

Two years ago, Neutra, who is on leave from his position as acting chief of DHS's environmental health investigations branch, was embroiled in a controversy surrounding the investigation of a cancer cluster at the Slater School in Fresno, CA (see *MWN,* J/F93 and M/A93). He said that once the EMF program is in place, the DHS will be able to avoid acrimony in similar situations. "We will have the resources to respond more quickly and to communicate with people more continuously," he said. He added that the EMF program will enable the DHS "to take a position on the basis of more information. We will be able to make decisions based on fact."

San Diego Utility Seeks Dismissal of Devaluation Case

Undaunted by the dismissal of their neighbors' EMF–property devaluation suit, a San Clemente, CA, couple are pursuing their own case against San Diego Gas & Electric Co. (SDG&E). But their case may never come to trial. The California Court of Appeals reversed a lower court decision against the utility and let SDG&E present arguments on November 16 to have the case dismissed. SDG&E contends the California Public Utilities Commission (CPUC) should have exclusive jurisdiction over health and safety issues related to power lines.

If the case is dismissed, "it would mean an end to power line EMF litigation in the state of California," said Michael Withey, who is representing the plaintiffs, Martin and Joyce Covalt. Withey, who is with the Seattle-based firm of Schroeter, Goldmark and Bender, said SDG&E "is trying to strangle EMF litigation in California and if the court were to agree to dismiss, it would have serious constitutional implications because it would violate the Covalts' right to due process." The case could be appealed to the state's Supreme Court.

The Covalts filed suit in 1993 against the utility, claiming property losses and damages from fear of EMFs. Their complaint is similar to that brought by Mark and Cheryl McCartin and two other couples in the Covalts' neighborhood. A California Superior Court judge dismissed the McCartin complaint in May (see *MWN,* M/J94). It is being appealed.

The cases center on a 1990 upgrade of power lines above an existing right-of-way near dozens of homes. SDG&E added a 12 kV circuit to two existing 12 kV lines. Magnetic fields exceed 4 mG in significant portions of the McCartins' home and 12 mG in the Covalts'.

SDG&E Assistant General Counsel Greg Barnes said a dismissal would mean the Covalts could go before the CPUC and "challenge CPUC's regulations, challenge the way SDG&E built its lines and seek to have them moved or put underground." They could not, however, recover monetary damages.

Meanwhile, buoyed by the success last year of the landmark Criscuola decision, two more property owners in New York are suing utilities for property devaluation. The two new cases bring to seven the number of similar lawsuits being handled jointly by the New York City law firms of Sive, Paget & Riesel and Goldstein, Goldstein & Rikon. Attorney Michael Rikon represented the Criscuolas when the state's Court of Appeals ruled that they could recover damages without linking EMFs to health problems (see *MWN,* N/D93, J/F94 and J/A94).

In one case, a Suffolk County couple is suing Long Island Lighting Co. (LILCO) for $285,000 in compensation for the value of their property, plus damages, attorneys' fees and costs. A couple in Westchester County is suing Consolidated Edison Co. (Con Ed) for $239,000, also in compensation for the value of their property, plus damages, attorneys' fees and costs.

Elaine Davis, a LILCO spokesperson, said she could not comment directly about the case. But she pointed out that the housing market on Long Island is depressed because of the recession, which would affect the value of any property. Con Ed spokesperson Martin Gitten said Con Ed does not comment about lawsuits while they are being litigated.

HIGHLIGHTS

« Cellular Phone Notes »

The litigation against cellular telephone manufacturers continues to grow, with at least two new cases filed recently—bringing the total to seven—and more to come. Brain tumor claims are "popping up everywhere now," said attorney Bruce Goodhart of Holstein, Mack & Klein in Chicago. His firm filed a lawsuit against **Motorola** Inc. and **NEC** Corp. for a Connecticut man, **Todd Hoffman**, on October 28 and was preparing a claim for an Arizona resident as we went to press in late November. Separately, **Richard Ward** of Fayetteville, GA, sued Motorola on October 7, alleging that the hand-held phone he used was responsible for the right frontal astrocytoma with which he was diagnosed in February 1991. Goodhart told *Microwave News* that he knows of possible cases being weighed by lawyers in California, North Dakota and Oregon. The new cases are similar to the other brain tumor claims that have been filed in the last three years (see *MWN,* J/A93, J/F94 and J/A94). Ward and Hoffman used the phones for a year-and-a-half and three years, respectively, prior to the diagnoses of their cancers. Ward argues in his complaint that his tumor "was caused by, exacerbated and/or made inoperable" by radiation from the phone. Hoffman's complaint mentions only "aggravation or acceleration of an existing tumorous condition." **Norman Sandler**, a spokesperson for Motorola in Schaumburg, IL, declined to discuss specifics of the new cases, but he called the allegations in all the lawsuits against Motorola "speculative." Ward's case was filed in Georgia state court and later moved to U.S. District Court in Atlanta by the defendants, according to **Ronald Polly** of Dennis, Corry, Porter & Gray in Atlanta, one of Ward's attorneys. Hoffman's suit and three other claims being handled by Holstein, Mack & Klein are all in state court in Chicago. The first lawsuit to allege injury from a hand-held cellular phone was brought in 1992 by a Florida man, David Reynard, whose wife died of a brain tumor (see *MWN,* M/J92 and J/F93). No case has, as yet, gone to trial.

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Calculations by Drs. **Peter Dimbylow** and **Simon Mann** of the U.K.'s National Radiological Protection Board show that a 0.6 W generic transceiver, when used in "the most typical position"—2 cm from the body—produced maximum SARs in the head of 1.4 and 2.9 W/Kg at 900 MHz and 1.8 GHz, respectively, when averaged over 1 g of tissue. The calculations showed that the SARs would rise to 2.8 and 4.6 W/Kg at 900 MHz and 1.8 GHz, respectively, if the transceiver was placed in front of an eye. The maximum SARs in the eye would be somewhat lower. (The researchers found that up to 44% of the output power of the unit was absorbed in the head.) These levels are in general agreement with those reported by Dr. **Niels Kuster**'s group at ETH in Zurich, Switzerland (see *MWN,* J/F94), but are higher than the revised estimates reported by Dr. **Om Gandhi** of the University of Utah, Salt Lake City, at last summer's Bioelectromagnetics Society meeting (see *MWN,* J/A94 and S/O94). Dimbylow and Mann conclude

that applying the ANSI/IEEE standard for an uncontrolled environment of 1.6 W/Kg in 1 g of tissue "results in maximum [output] powers of 0.34 and 0.21 W at 900 MHz and 1.8 GHz," respectively. Their paper appears in *Physics in Medicine and Biology (39,* pp.1537-1553, 1994) and includes color diagrams of the SAR distributions.

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Germany's **Research Association for Radio Applications** — Forschungsgemeinschaft Funk, or **FGF**—has announced that it has found no cancer risk from exposures to microwave radiation like that used in mobile communications. In 1993, FGF began a research program on the "Biological Effects of High Frequency Electromagnetic Waves to Man and Environment," consisting of twelve different projects. Six have now been completed and the results of three studies—from the Technical University of Braunschweig, from the Free University of Berlin and from the University of Bonn—were announced in Germany in mid-November. FGF's **Gerd Freidrich** told *Microwave News* that these findings "did not hint at cancer-causing or cancer-promoting effects." FGF was established in September 1992 as a nonprofit group. Its members include Ericsson Mobile Communications, German Telekom, Motorola, Nokia and Siemens, as well as two broadcast networks, ARD and ZDF, and the German Federal Ministry of Posts and Telecommunications. (See box at left.)

German Telekom Cellular Phone Studies

The following research projects on the health effects of cellular telephone, primarily digital (GSM), radiation have been funded by German Telekom over the last three years. Locations are in Germany unless otherwise noted. German Telekom's Dr. Thomas Damboldt, based in Darmstadt, did not respond to repeated requests to provide further details. Completion dates could not be confirmed.

Dr. Eduard David Institute of Physiology, University of Witten/ Herdecke, Witten	Long-term effects on complex biological systems (animals, tissues, cells).
Dr. W. Dimpfel Pro Science Linden	Effects on human electro-encephalograms (EEGs) of Mega-Wave therapy equipment and digital phones.
Dr. Jürg Kohli Institute of General Microbiology, University of Bern, Switzerland	Effects on living cells.
Dr. Uwe Kullnick Institute of Zoology, Technical University of Braunschweig	Neurophysiological effects;* effects on the human nervous system of pulsed and non-pulsed radiation.
Dr. Niels Kuster Institute of EMF and MW Electronics, Swiss Federal Institute of Technology (ETH), Zurich	Energy absorption by human tissue (dosimetry).†
Dr. Joachim Röschke Department of Psychiatry, University of Mainz	Effects on EEGs (sleep patterns)—two contracts.*†
Dr. Peter Semm Institute of Zoology, University of Frankfurt	Effects on the optic nerve of the zebra finch and pigeon and on the visual neurons of other birds and insects;* effects on the synthesis of melatonin in birds and humans;* literature review.*
Dr. Franz Thoss Carl-Ludwig Institute of Physiology, University of Leipzig	Effects on the human central nervous system.*
Dr. Lutz Vollrath Institute of Anatomy, University of Mainz	Biological effects.*

* Study completed.

† For more on Kuster's dosimetry studies, see *MWN,* J/F94; for more on Röschke's sleep pattern research, see *MWN,* M/J94.

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Both epidemiological and laboratory studies are needed to determine whether cellular telephones pose any health risks, concluded a **General Accounting Office** (GAO) report released in late November. The report, which was commissioned by Rep. **Edward Markey** (D-MA) two years ago (see *MWN,* S/O93 and S/O94), noted that some recent biological and behavioral animal and cellular experiments indicate possible health effects from low-level RF/MW radiation, although none has specifically looked at the frequencies used by cellular telephones. The GAO also recommended that the **EPA**, **FCC** and **FDA** work with the Cellular Telecommunications Industry Association's (CTIA) Scientific Advisory Group (SAG) on Cellular Telephone Safety "to maximize the usefulness, independence and objectivity of [the group's] planned research initiative." On November 21, after reviewing the report, Markey wrote to President **Bill Clinton** suggesting that the President designate a government representative to ensure that this interagency issue is addressed promptly. "It is not appropriate to uncritically rely on affected industries to assess the health consequences of the use of their products or services," Markey explained. The same day CTIA President **Thomas Wheeler** wrote to Markey expressing his disappointment over Markey's statements. Wheeler argued that the "tone" implied incorrectly that the GAO had linked cellular phones with health effects. The GAO report was virtually ignored by the press, except for a story on CNN's *Moneyline*. Copies of *Status of Research on the Safety of Cellular Telephones* (GAO/RCED-95-32) are available from: U.S. GAO, PO Box 6015, Gaithersburg, MD 20884, (202) 512-6000. The first copy is free and additional copies are $2.00.

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The **European Community** (EC) is concerned over possible radiation hazards from wireless devices. Researchers at the Center for Personkommunikation at Aalborg University in Aalborg, Denmark, led by Professor **Jørgen Bach Andersen**, have begun a study for the EC on health issues related to the

growing use of wireless devices for voice and data communications. Both thermal and athermal (low-level) effects will be reviewed, Andersen told *Microwave News.* The study was requested by the telecommunications directorate of the European Commission. A report should be available next spring, Andersen said.

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CTIA's **SAG** sponsored an *RF Exposure and Dosimetry Workshop on Small Animal and* in vitro *Exposure Systems* in Los Angeles, December 2-3. Among the agenda items was a discussion of head-only versus whole-body exposure systems. "We are trying to simulate exposures from the phones," SAG's Dr. George Carlo told us. "We must be able to define what the exposure is." The Los Angeles meeting follows SAG's October 28 *National Symposium on Wireless Transmission Base Station Facilities,* held in Philadelphia.

Fetal Loss Found Among Rats Exposed to DC Magnetic Fields

Pregnant rats exposed to 30 mT (300 G) static magnetic fields had significantly fewer live fetuses than unexposed rats, according to a new study by Drs. Meike Mevissen, Siegfried Buntenkötter and Wolfgang Löscher. The researchers cautioned, however, that more work is needed before the relevance of this finding for humans is known.

Writing in the September 1994 *Teratology (50,* pp.229-237), the researchers, from the School of Veterinary Medicine in Hannover, Germany, reported that fetal resorptions—similar to miscarriages in humans—were 13.9% among exposed rats as compared to 3.9% among controls. They did not observe any serious malformations in the live fetuses.

In an interview with *Microwave News,* Löscher said that his interest in static fields grew out of concern in Germany that magnetic resonance imaging (MRI) technicians have higher-than-average rates of spontaneous abortions. He said this was the first study to use an exposure comparable to field levels to which technicians are exposed.

There were no significant effects on the number of live fetuses in rats exposed to 30 mT 50 Hz magnetic fields. Exposed fetuses had significantly more minor skeletal anomalies than unexposed fetuses, however.

Both groups (DC and AC) of exposed fetuses showed increased skeletal ossification, which the German team said might indicate accelerated prenatal development. In another experiment, the birth weight of rats born to mothers exposed to DC fields was significantly higher than that of the offspring of unexposed rats.

The researchers concluded that exposing pregnant rats to magnetic fields like those in which MRI technicians work "does not induce any major teratogenic effect but seems to slightly increase fetal loss."

Research earlier this year.

The cellular phone industry is concerned about the new results. Representatives from Motorola and from the Cellular Telephone Industry Association's (CTIA) Scientific Advisory Group (SAG) on Cellular Telephone Research have visited Lai and Singh's lab a number of times over the last few months.

Despite all the attention, however, the industry is taking a skeptical and dismissive view of the experiments and their implications—and the SAG has angered Lai and Singh. "The validity of the Lai–Singh experiment has yet to be established and, even if it is validated, the effects it purports to show may be inconsequential," Dr. Quirino Balzano, a Motorola corporate vice president, told *Microwave News*. In August, Balzano, accompanied by Dr. Asher Sheppard, an independent consultant to Motorola based in Redlands, CA, went to Seattle to meet with Lai and Singh.

Dr. Ian Munro of CanTox Inc. in Mississauga, Canada, one of the three SAG members, commented that the results of the assay are of "unknown and unclear public health significance." And Dr. George Carlo, the chairman of the SAG, who is setting up a research program on cellular phone health risks for the CTIA (see *MWN,* S/O94), has written that, " It is unclear what relevance [the Lai–Singh data] has to our program."

The third member of the SAG is Dr. Bill Guy, a professor emeritus at the University of Washington and a longtime collaborator of Lai's at the university's Bioelectromagnetics Research Laboratory. Guy designed the microwave exposure system used by Lai and Singh. In an interview, Guy said that he had a "strong conflict of interest" and that, "For the present, I'm reserving my judgment."

One of the industry's key concerns is whether the assay used by Lai and Singh is a reliable and reproducible indicator of DNA damage. The assay—formally called alkaline microgel electrophoresis, but better known as the "comet" assay because it causes the broken-down DNA to spread out like the tail of a comet—was originally developed by Singh and others in the 1980s. Singh stands by the new microwave results: "The data are very impressive and are very interesting," he told *Microwave News.*

The SAG convened an expert panel in Bedminster, NJ, on October 19 to assess the comet assay and the Lai–Singh work. The panel, which was chaired by Dr. Richard Setlow, the associate director for life sciences at Brookhaven National Lab in Upton, NY, "found a number of uncertainties and inconsistencies in the Lai–Singh data," according to Carlo. Setlow refused to comment on the meeting.

In a November 16 memo to Carlo, Munro reported that the expert panel "recommended that the experiment be repeated" as long as "numerous limitations" are corrected. But in the same memo, Munro concluded that, "It is our position that from both a scientific and a priority perspective it may be premature to repeat and extend the Lai–Singh work." Munro said that he would prefer to wait on an international group of researchers that is planning to examine the validity of the assay. "It is probably inappropriate to spend a lot of money to repeat the experiment when we are not sure it is producing a valid result," Munro said.

Last spring, approximately 50-60 scientists held a work-

shop in England to review research on the comet assay, including its use in genetic toxicology, according to Dr. Ray Tice of Integrated Laboratory Systems in Research Triangle Park, NC, who attended both the comet workshop and the October 19 SAG meeting. On March 12, many of the same scientists will resume these discussions at the *Annual Meeting of the Environmental Mutagen Society* in St. Louis. On the agenda is a plan to set up a validation study for the assay, which, once under way, would take about a year to complete, Tice said.

The question of when the SAG will replicate the Lai–Singh study will now be presented to the Harvard Center for Risk Analysis peer-review group on cellular phones (see *MWN,* J/A94). In a November 17 letter to Dr. John Graham, the director of the Harvard center in Boston, Carlo asked: "Should a repeat of the *in vivo* comet assay be deferred until the international validation is completed and we have a more thorough understanding of this assay technique?"

On December 1, Dr. Susan Putnam, a research associate at the Harvard center, said that as soon as she receives complete background information from the SAG, she will forward it to a subset of her peer-review group. She declined to predict when she would have a response for Carlo.

Many of those who know about the Lai–Singh data believe that replication studies should move forward now. "Results like these deserve a follow-up," Dr. Elizabeth Jacobson told *Microwave News*. Jacobson is the deputy director for science at the Food and Drug Administration's (FDA) Center for Devices and Radiological Health (CDRH) in Rockville, MD.

"My opinion as a scientist is that it should be pursued and should be replicated in other labs," Tice said in an interview, adding that, "The data from the validation study will be useful in interpreting these results." And Sheppard, Motorola's consultant, commented, "I think that the work needs to be replicated and explored further."

Early this year, Lai and Singh asked the SAG for $240,000 (of which $50,000 would have been for lab equipment) from the $15-25 million research fund set up by the cellular phone industry (see *MWN,* J/F93 and J/A93). But in early November, they became so frustrated that they withdrew their proposal. "They are moving too slowly," Lai said. He added that he could not understand the delays over validation since many labs are using the comet assay and at least three other labs have used it to examine DNA breaks in brain tissue. A group led by Dr. Luc Verschaeve at VITO, the Flemish Technological Research Institute, in Brussels, Belgium, reported effects of mobile telephone radiation on blood lymphocytes as determined by the comet assay, at last June's *Annual Meeting of the Bioelectromagnetics Society* in Copenhagen, Denmark.

The relationship between Lai and Singh and the SAG has been tense since Lai and Singh were not allowed to attend the October 19 panel workshop. "They invited us twice, but then they forgot about us," Lai said. Singh remains bitter about this episode: "When you are executing a person, you should have a fair trial," he said.

Carlo responded that a decision was made that attending the workshop "would not be the best use of Lai and Singh's time." Munro said that it was common practice not to invite researchers to a peer review of their own work. Both Carlo and Munro noted that Lai and Singh continue to serve as consultants to the SAG, attending workshops and other meetings.

Guy, a colleague of both Lai's and Carlo's, said that Lai should expect some controversy. "I told Henry that 'You've got dynamite in your hands—if it turns out to be a real effect, the implications are tremendous,'" Guy told *Microwave News.* If Lai and Singh are correct, their results will have implications far beyond the cellular phone industry because of the low exposure levels implicated. "These are levels that could stimulate a reevaluation of the ANSI/IEEE standard," Sheppard said.

Lai wants to continue his studies: "We did not ask for a lot of money—we should be doing science instead of all this politics," he said.

On September 30, the SAG signed a letter of intent with Dr. Martin Meltz for *in vitro* studies of DNA damage using the comet assay. The proposal from Meltz, who is the director of the Center for Environmental Radiation Toxicology at the University of Texas Health Sciences Center in San Antonio, TX, has not yet been considered by the Harvard peer-review panel. Carlo said that no "definitive experiment" would begin until it wins Harvard approval, which he anticipates getting by the beginning of 1995. Meltz requested $95,000, which includes $13,000 for lab equipment.

While a decision on when to replicate the Lai–Singh experiment is pending, Dr. Jerry Phillips in Dr. Ross Adey's lab at the VA Hospital in Loma Linda, CA, is gearing up to repeat the Indian study but at cellular phone frequencies. "We are going to look at DNA damage in brain tissue exposed *in vivo* and in brain tumor cells exposed *in vitro* using the Sarkar method," Phillips said. He pointed out that the comet assay requires sophisticated and expensive equipment to which he does not have access.

Lai and Singh are not the first to report that microwaves can cause breaks in DNA. In the mid-1980s, FDA's Drs. Jose-Luis Sagripanti and Mays Swicord, working with Dr. Christopher Davis of the University of Maryland, College Park,

The Lai–Singh Experiment

Rats were exposed for two hours to either continuous wave (CW) or pulsed (500 2 ∝sec pulses per second) 2450 MHz radiation at a power density of 2 mW/cm^2, corresponding to a specific absorption rate (SAR) of 1.2 W/Kg. The researchers used the comet assay to measure DNA breaks.

Four hours after exposure to the pulsed signals, Lai and Singh found a significant increase in single-strand DNA breaks in the hippocampus, as well as in the rest of the brain of the rats. But no significant effect was observed immediately after a two-hour exposure. A similar effect was also seen for 1 mW/cm^2 (SAR = 0.6 W/Kg) and there appeared to be a dose–response relationship.

For CW exposures, a significant increase in DNA breaks in the rats' brains was found both immediately after exposure and four hours later.

Lai told *Microwave News* that there were approximately 20% and 30% more DNA breaks after exposure to CW and pulsed microwaves, respectively, as compared to controls.

Clippings from All Over

Early research did raise legitimate concerns about the health effects of [EMFs]. Since then, most studies have found no association, but there are occasional chance findings—blips—that keep the issue on the table. No study, of course, can ever *prove* that EMFs (or anything else) are safe. But none of the 30 to 40 studies done in the last 10 years has provided any convincing evidence that EMFs cause birth defects, childhood cancers, breast cancer in women, or other problems.

—Dr. Patricia Buffler, University of California, Berkeley, quoted in "A Clear Point of View: Patricia Buffler on EMFs," *University of California at Berkeley Wellness Letter,* p.2, November 1994

To those physicists and biologists who understand the fundamental science, Jamie Robins, a Harvard epidemiologist, observes, EMF-induced cancer seems almost as implausible as, for instance, ESP-induced cancer. Because epidemiologists don't understand physics as well as physicists do, or biology as well as biologists do, they are not constrained by a strong prejudice toward the "null hypothesis"—the assumption that the phenomenon in question is nonexistent. As a result, Robins says, epidemiologists will gladly give credence to dubious studies of EMF in a way they never would to similar studies of ESP, the implausibility of which they understand.

—Gary Taubes, "Fields of Fear," *Atlantic Monthly,* pp.102, 108, November 1994. The article ran with the following subhead: "People want to believe that [EMFs] are bad for them, and so they do. A study in how the selective reporting of scientific evidence—by researchers as well as journalists—can generate anxiety at the expense of reality."

"If you're sick, do you go to a physicist?" [Professor Dan Wartenberg of Rutgers University] said that he is very careful not to speak about physics questions outside his field—like how to minimize EMF fields. Physicists should do the same, he said. The debate is one of argument and counter-argument—with the public's health riding on the final score. The Edison Electric Institute, an industry group, argues that there has been "no established biological mechanism" to explain the EMF–cancer link, and so cancer in the studies must have other causes. Wartenberg responds that the National Cancer Institute officially recommends eating fresh fruits and vegetables to reduce cancer risk, although they admit ignorance of exactly why those foods help. EMF studies are no different, he said—the results are still persuasive, even if the exact mechanism[s] are not well understood.

—David Newhouse, "Sparks Continue To Fly in Debate Over EMFs," *The Times* (Trenton, NJ), p.8, November 21, 1994

Craig McCaw [is] the kind of man who...once suggested in all apparent seriousness—as color drained from the face of a PR man in attendance—that the Federal Communications Commission should reserve spectrum for telepathic communications to be made possible by brain implants he thinks will exist some day.

—Andrew Kupfer, "AT&T's $12 Billion Cellular Dream," *Fortune,* p.102, December 12, 1994

The worst thing that utility systems could do would be to dismiss EMF health risk findings. But I also believe that there is danger in according to the EMF riddle the status of a probable health risk requiring enormous amounts of study. If the utility industry in its zeal to be responsive creates too large an issue over EMF, it runs the risk of reaching a kind of problematic critical mass which will continue to generate a long series of relatively expensive studies. These will never prove what is going on or definitively disprove it either....The time is coming to take a harder line against the small industry of people who are attempting to use litigation to extract payoffs from utility companies by convincing a jury that the utilities have known of EMF dangers but have done nothing about them.

—Cyrus Noë, "EMF Health Effects Update: It's Time To Take a Harder Line," *Clearing Up: Northwest Energy Markets,* a newsletter based in Seattle, pp.1-6, November 21, 1994

The presence of high-power transmission lines is like a double-edged sword of Damocles affecting perhaps the physical health, but surely the economic health, of landowners. It hangs over the heads of the utilities as well. In their own economic self-interest, if not concern for the public, utilities should press the appropriate state and federal authorities to study the problem and come up with definitive answers to the EMF puzzle before utilities and customers suffer severe, dire consequences.

—Dr. Sharlene McEvoy, "Double-Edged Sword of Damocles: Utility Companies' Liability for Diminution of Property Values Due to Electromagnetic Fields," *Real Estate Law Journal, 23,* p.122, 1994

found that microwave radiation acts synergistically with copper to cause single- and double-strand breaks (see *MWN,* M/J87). In a recent interview, Swicord, the chief of the molecular biology branch at FDA's CDRH, commented that, "The speculation is that this is a possible mechanism for causing DNA damage that could have significant health effects."

SAG's Munro pointed out that he does not put as much emphasis on single-strand breaks as on mutations. "Stable mutations are a much more serious matter," he said.

Dr. Kenneth Tindall, the head of the molecular mutagenesis group at the National Institute of Environmental Health Sciences (NIEHS) in Research Triangle Park, NC, said that, "The jury is still out on the biological significance of single-strand breaks," explaining that, "The classic view is that they are not important, but more recent research suggests certain types of breaks may not be easily repaired and could lead to a biological effect." The NIEHS is a sponsor of Lai's work on the search for a possible mechanism to explain microwave interactions with neurological function.

Indeed, Lai argues that the microwave radiation does not cause direct damage to the DNA. "I would bet that an enzyme repair mechanism is being affected," he said.

Nor are Lai and Singh the first to show that microwaves can transform DNA. Drs. Elizabeth Balcer-Kubiczek and George Harrison of the University of Maryland School of Medicine in Baltimore found that 2.45 GHz radiation, modulated at 120 Hz, causes cells to become cancerous if they are later treated with a tumor promoter (see *MWN,* J/A89). "We unequivocally showed neoplastic transformation after microwave irradiation followed by the application of the tumor promoter TPA," Harrison told *Microwave News*. And in a series of studies, a group of Croatian researchers found that radar radiation can lead to chromosomal aberrations (see *MWN,* M/J92).

Elizabeth Balcer-Kubiczek and George Harrison, "Neoplastic Transformation of C3H/10T½ Cells Following Exposure to 120 Hz Modulated 2.45 GHz Microwaves and Phorbol Ester Tumor Promoter," *Radiation Research, 126,* pp.65-72, 1991.

Vera Garaj-Vrhovac, Durda Horvat and Zlatko Koren, "The Effect of Microwave Radiation on the Cell Genome," *Mutation Research, 243,* pp.87-93, 1990 (for references to related Croatian studies, see *MWN,* M/J92).

Henry Lai and Narendra Singh, "Acute Low-Intensity Microwave Exposure Increases DNA Single-Strand Breaks in Rat Brain Cells," *Bioelectromagnetics, 16,* 1995 (in press).

Jose-Luis Sagripanti, Mays Swicord and Christopher Davis, "Microwave Effects on Plasmid DNA," *Radiation Research, 110,* pp.219-231, 1987.

Soma Sarkar, Sher Ali and J. Behari, "Effect of Low-Power Microwave on the Mouse Genome: A Direct DNA Analysis," *Mutation Research, 320,* pp.141-147, 1994.

N.P. Singh, R.E. Stephens and E.L. Schneider, "Modifications of Alkaline Microgel Electrophoresis for Sensitive Detection of DNA Damage," *International Journal of Radiation Biology, 66,* pp.23-28, 1994.

CONFERENCES

1995 Conference Calendar

January 3-7: **National Radio Science Meeting,** University of Colorado, Boulder. For Commission K, Electromagnetics in Biology and Medicine, contact: Dr. James Lin, University of Illinois, 851 South Morgan St., Chicago, IL 60607, (312) 413-1052, Fax: (312) 413-0024.

January 25-26: **EMI/EMC Metrology Challenges for Industry Workshop,** National Institute of Standards and Technology (NIST), Boulder, CO. Contact: Ann Bradford, NIST, 813.07, 325 Broadway, Boulder, CO 80303, (303) 497-3321, Fax: (303) 497-6665.

January 29-February 2: **1995 IEEE Power Engineering Society (PES) Winter Meeting,** Hilton Towers, New York, NY. Contact: Nancy Heitmann, IEEE-PES Special Services, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855, (908) 562-3881, Fax: (908) 562-1571.

February 15-18: **1st Regional Conference of the IEEE Engineering in Medicine and Biology Society** and **14th Annual Conference of the Biomedical Engineering Society of India,** New Delhi, India. Contact: Sujoy Guha, Center for Biomedical Engineering, Indian Institute of Technology, New Delhi 110016, India, (91+11) 685-7785, Fax: (91+11) 686-2037.

February 21-23: **Waipuna RF Meeting,** Waipuna Lodge International Hotel, Auckland, New Zealand. Contact: Dr. David Black, PO Box 26-105, Epsom, Auckland 1030, New Zealand, Fax: (64+9) 256-3969.

March 5-9: **1995 Society of Toxicology (SOT) Meeting,** Convention Center, Baltimore, MD. Contact: SOT, 1767 Business Center Dr., Suite 302, Reston, VA 22090, (703) 438-3115, Fax: (703) 438-3113.

March 7-9: **11th International Zurich Symposium & Technical Exhibition on Electromagnetic Compatibility,** Federal Institute of Technology, Zurich, Switzerland. Contact: Dr. Gabriel Meyer, ETH Zentrum-IKT, CH-8092 Zurich, Switzerland, (41+1) 632-2790, Fax: (41+1) 262-0943.

March 12-16: **26th Annual Meeting of the Environmental Mutagen Society,** Union Station Hyatt Regency, St. Louis, MO. Contact: Ray Tice, Drohan Management Group, 11250-8 Roger Bacon Dr., Suite 8, Reston, VA 22090, (703) 437-4377, Fax: (703) 435-4390.

March 19-22: **1995 EPRI EMF Seminar,** Marriott Hotel, San Jose, CA. Contact: Vicki Prock, Robert S. Banks Associates Inc., 2701 University Ave., SE, Suite 203, Minneapolis, MN 55414, (612) 623-4600, Fax: (612) 623-3645.

March 26-31: **1995 Electricity Conference,** Hyatt Regency Hotel, Vancouver, BC, Canada. Contact: Canadian Electrical Association, 1 Westmount Sq., Suite 1600, Montréal, PQ H3Z 2P9, Canada, (514) 937-6181, Fax: (514) 937-6498.

March 29-31: **T&D World Exposition '95,** Convention Center, New Orleans, LA. Contact: Stuart Lewis, Intertec Publishing Corp., 9800 Metcalf Ave., Overland Park, KS 66212, (913) 967-1745. Fax: (913) 967-1905.

April 4-6: **American Public Power Association (APPA) Engineering & Operations Workshop & Trade Show,** Convention Center, Philadelphia, PA. Contact: APPA, 2301 M St., NW, Washington, DC 20037, (202) 467-2965, Fax: (202) 467-2990.

April 9-13: **Experimental Biology '95,** Georgia World Congress Center, Atlanta, GA. Contact: Experimental Biology '95, 9650 Rockville Pike, Bethesda, MD 20814, (301) 530-7010, Fax: (301) 530-7014.

April 9-13: **1995 Conference and Exhibition of the National Association of Broadcasters (NAB),** Convention Center, Las Vegas, NV. Contact: NAB, 1771 N St., NW, Washington, DC 20036, (800) 342-2460, Fax: (301) 216-1847.

April 12-13: **31st Annual Meeting of the National Council on Radiation Protection and Measurements (NCRP),** Crystal City Marriott, Arlington, VA. Contact: NCRP, 7910 Woodmont Ave., Suite 800, Bethesda, MD 20814, (800) 229-2652, Fax: (301) 907-8768.

May 7-11: **27th Annual National Conference on Radiation Control,** San Antonio, TX. Contact: Conference of Radiation Control Program Directors Inc., 205 Capital Ave., Frankfort, KY 40601, (502) 227-4543, Fax: (502) 227-7862.

May 8-10: **International Conference on Electromagnetic Energy,** Loews L'enfant Plaza Hotel, Washington, DC. Contact: Electromagnetic Energy Association, 1255 23rd St., NW, Suite 850, Washington, DC 20037, (202) 452-1070, Fax: (202) 833-3636.

May 8-11: **Radar '95: IEEE International Radar Conference,** Radisson Plaza Hotel, Alexandria, VA. Contact: Randy Belote, ITT Defense & Electronics, 1650 Tysons Blvd., Suite 1700, McLean, VA 22102, (703) 790-6336, Fax: (703) 790-6365.

May 11-13: **Hyperthermia in Clinical Oncology,** Delft, The Netherlands. Contact: Inge Dijkstra, Dept. of Radiotherapy, Groene Hilledijk 301, PO Box 5201, NL-3008 AE Rotterdam, The Netherlands, (31+10) 439-1798, Fax: (31+10) 486-4596.

May 16-19: **MTT-S International Microwave Symposium,** Orlando, FL. Contact: Keith Huddleston, Martin Marietta, MP 200, PO Box 555837, Orlando, FL 32855, (407) 356-7201, Fax: (407) 356-0933.

May 20-26: **1995 American Industrial Hygiene (AIHA) Conference & Exposition,** Roe Bartle Hall, Kansas City, MO. Contact: AIHA, 2700 Prosperity Ave., Suite 250, Fairfax, VA 22031, (703) 849-8888, Fax: (703) 207-3561.

May 22-23: **2nd Copenhagen Conference on Electromagnetic Hypersensitivity,** Copenhagen, Denmark. Contact: Jyrki Katajainen, Dept. of Computer Science, University of Copenhagen, Universitetsparken 1, DK-2100 Copenhagen East, Denmark, Fax: (45+1) 35321401.

June 18-22: **17th Annual Meeting of the Bioelectromagnetics Society (BEMS),** Park Plaza Hotel, Boston, MA. Contact: Dr. William Wisecup, BEMS, 7519 Ridge Rd., Frederick, MD 21702, (301) 663-1915, Fax: (301) 371-8955.

June 18-23: **1995 IEEE AP-S International Symposium and USNC/URSI Radio Science Meeting,** Newport Beach, CA. Contact: 1995 IEEE AP-S Symposium, Jet Propulsion Lab T-1703, 4800 Oak Grove Dr., Pasadena, CA 91109, (818) 354-3835.

June 22-24: **28th Annual Meeting of the Society for Epidemiologic Research (SER),** Snowbird, UT. Contact: Stacey Norin, SER, 111 Market Pl., Suite 840, Baltimore, MD 21202, (410) 223-1600, Fax: (410) 223-1620.

July 9-12: **30th Annual Microwave Symposium,** Hyatt Regency Hotel, Denver, CO. Contact: International Microwave Power Institute, 10210 Leatherleaf Court, Manassas, VA 22111, (703) 257-1415, Fax: (703) 257-0213.

July 23-27: **40th Meeting of the Health Physics Society (HPS),** Hynes Convention Center, Boston, MA. Contact: HPS Administrative Services, 1313 Dolley Madison Blvd., Suite 402, McLean, VA 22101, (703) 790-1745, Fax: (703) 790-2672.

July 23-27: **1995 IEEE PES Summer Meeting,** Portland, OR. Contact: See IEEE-PES, January 29-February 2, above.

July 24-28: **Progress in Electromagnetics Research Symposium (PIERS),** University of Washington, Seattle. Contact: 1995 PIERS, UW Engineering Professional Programs, 3201 Fremont Ave. North, Seattle, WA 98103, (206) 543-5539, Fax: (206) 543-2352.

August 14-18: **1995 IEEE International Symposium on Electromagnetic Compatibility,** Marriott Marquis, Atlanta, GA. Contact: See IEEE-PES, January 29-February 2, above.

August 19-25: **1995 Meeting of the Society of Magnetic Resonance (SMR),** Acropolis Center, Nice, France. Contact: Cordie Miller, SMR, 2118 Milvia, Suite 201, Berkeley, CA 94704, (510) 841-1899, Fax: (510) 841-2340.

August 31-September 1: **4th Nordic Workshop on Biological Effects of Low Frequency EMFs,** University of Kuopio, Finland. Contact: Dr. Jukka Juutilainen, Dept. of Environmental Sciences, University of Kuopio, PO Box 1627, 70211 Kuopio, Finland, (358+71) 163226, Fax: (358+71) 163230.

September 5-7: **International Conference on 100 Years of Radio,** Contact: Institution of Electrical Engineers, Savoy Pl., London WC2R 0BL, U.K., (44+71) 344-5477, Fax: (44+71) 497-3633.

September 11-14: **17th Annual Electrical Overstress/Electrostatic Discharge Symposium,** Hyatt Hotel, Phoenix, AZ. Contact: Electrostatic Discharge Association, Fleet Bank Bldg., 200 Liberty Plaza, Rome, NY 13440, (315) 339-6726, Fax: (315) 339-6793.

September 20-23: **17th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBS)** and **21st Canadian Medical and Biological Engineering Conference,** Montréal, Canada. Contact: Coplanor Congrès Inc., 511 Place d'Armes, Suite 600, Montréal, PQ H2Y 2W7, Canada, (514) 848-1133, Fax: (514) 288-6469.

September 26-28: **1995 International Aerospace and Ground Conference on Lightning and Static Electricity,** Williamsburg, VA. Contact: Sam Frazier, Naval Air Warfare Center, Aircraft Division, PO Box 928, Patuxent River, MD 20670, (301) 826-3868, Fax: (301) 826-3871.

October 2-4: **EMF National Debate & Summit Meeting,** Sheraton National Hotel, Arlington, VA. Contact: Betsy Norberg, Intertec Publishing Corp., PO Box 12901, Overland, KS 66282, (913) 967-1865, Fax: (913) 967-1898.

October 6-9: **15th Annual Meeting of the Society for Physical Regulation in Biology and Medicine,** Hyatt Regency, Crystal City, VA. Contact: Dr. Kenneth McCleod, Dept. of Orthopaedics, Health Science Center, T-18 Room 030, State University of New York, Stony Brook, NY 11794, (516) 444-2215, Fax: (516) 444-7671.

October 29-November 3: **7th IEEE PES International Conference on Transmission & Distribution Construction, Operation & Live-Line Maintenance,** Hyatt Regency, Columbus, OH. Contact: Tai Wong, American Electric Power Service Corp., 1 Riverside Plaza, Columbus, OH 43215, (614) 223-2235, Fax: (614) 223-1823.

UPDATES

ELECTROMAGNETIC HYPERSENSITIVITY

European Notes... Sweden's highest insurance court has rejected a claim brought by Marianne Berg, a bank manager, that her skin condition was caused by video display terminal (VDT) EMF exposure at work. This could put at risk more than 30 other electrical hypersensitivity cases that are pending before the court, along with hundreds of regional and local claims, according to a report in *TCO-Tidningen,* the newspaper of the Swedish white-collar union TCO, based in Stockholm. The court found, "It is indisputable that many people experience a connection between VDT work and skin conditions, but there is still a lack of sufficient evidence that it is the screen that is the cause," the newspaper reported. Berg's case had been pending for a decade....Whether EMFs are linked to the skin complaints and such neurological symptoms as headaches, faintness, fatigue and sleep disorders experienced by those who say they are hypersensitive to electricity is still hotly debated. Dr. Olle Johansson and Peng-Yue Liu of the Experimental Dermatology Unit at the Karolinska Institute in Stockholm, Sweden, outlined preliminary research at the *Workshop on Electromagnetic Hypersensitivity,* held in Graz, Austria, September 26-27, indicating that VDT operators with electromagnetic sensitivities have dramatically different skin biopsies than controls. After a similar presentation at last June's *16th Annual Meeting of the Bioelectromagnetics Society* in Copenhagen, Denmark, Johansson told *Microwave News* that some of the skin biopsies were "so abnormal that I had a difficult time believing it." He added that, "While we don't know the cause, it's very hard to believe that only psychological factors are at work." But at the same meeting, Sheila Galt and Dr. Yngve Hamnerius of the Chalmers University of Technology in Göteborg, Sweden, and colleagues reported that none of 30 sub-

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jects could accurately detect whether they were being exposed to electric and magnetic fields. In contrast to Johansson's research, Dr. Bengt Arnetz of the Karolinska Institute and Drs. Mats Berg and Sture Lidén of the Karolinska Hospital argued at the *Work with Display Units '94 (WWDU'94)* conference held in Milan, Italy, October 2-5, that the main differences between those workers who say they are hypersensitive and other employees are that the former are more stressed at work and tend to feel underused. Dr. Ulf Bergqvist of the Swedish National Institute of Occupational Health in Solna, who opened a round-table discussion on electric hypersensitivity at *WWDU '94,* concluded that no clear causes have been identified but noted that a range of factors are currently being studied, including EMFs, chemicals, light, allergies and personality types. Dr. Stanislaw Szmigielski of the Center for Radiobiology and Radiation Safety in Warsaw, Poland—one of approximately 70 participants at the Graz meeting, sponsored by the European Community's project on biomedical effects of EMFs, known as COST 244—noted that while none of the research presented there objectively demonstrated that EMF hypersensitivities exist, a number of the studies found that 2-4% of the subjects showed measurable, though generally not significant, responses to weak 50 Hz fields. A study by Szmigielski and Dr. Marek Szuba of the Technical University of Wroclaw, Poland, found that 70 healthy volunteers had a statistically significant lengthening in reaction times to acoustic and visual signals when exposed for three minutes to high electric fields (10.9 and 13 kV/m)....The next major meeting will be the *2nd Copenhagen Conference on Electromagnetic Hypersensitivity* in Denmark, May 22-23, 1995; see p.14. (For more on electromagnetic hypersensitivity, see *MWN,* M/A87 and M/J91.)

EXPOSURE ASSESSMENT

Job Titles Can Be Misleading... Epidemiological studies that rely on job titles to gauge EMF exposures for certain jobs are apt to lump together workers with wide-ranging exposures, according to a study led by Dr. Patrick Breysse. Breysse and coworkers at the Johns Hopkins University (JHU) School of Hygiene and Public Health in Baltimore and Dr. William Kaune of EM Factors in Richland, WA, found that exposures of some "telephone lineworkers," presumed to be higher than those of other workers, were similar to those of "non-lineworkers." When exposure maxima were measured, only one category of linemen—cable splicers—could be distinguished from non-linemen. Cable splicers had average peak exposures of 99.2 mG compared to non-linemen's average of 29.1 mG. Splicers also had the highest average mean and median exposures, 4.3 and 3.2 mG, respectively. Central office technicians, who are also called lineworkers, had the second highest average means and medians (2.5 and 2.2 mG, respectively). But the average means and medians of the remaining two lineworker categories were indistinguishable from those of non-lineworkers (1.5 and 1.2 mG, respectively). The team concluded that using one "telephone lineworker" job category is "not appropriate" and that future studies should focus on cable splicers. The analysis, published in the November 1994 issue

of the *American Journal of Industrial Medicine (26,* pp.681-691), is an offshoot of JHU's Dr. Genevieve Matanoski's case–control study of leukemia among telephone workers, which found increasing leukemia mortality with increasing EMF exposures (see *MWN,* J/A91, M/A93 and M/J93). In a separate study, Matanoski reported that young cable splicers who worked for the New York Telephone Co. had higher rates of leukemia and other types of cancer (see *MWN,* N/D89 and J/A91). Breysse's study follows soon after a report by Dr. Birgitta Floderus that made a similar point. In a reassessment of a previous study, Floderus, of the National Institute of Occupational Health in Solna, Sweden, uncovered an excess risk of leukemia among railway workers when she took account of their changing levels of exposure from one decade to the next (see *MWN,* M/J94).

PEOPLE

Dr. **Andrew Bassett**, a pioneer in the use of PEMFs for the treatment of nonunion bone fractures, died of a brain tumor on November 14. Bassett founded Electro-Biology Inc., which markets PEMF devices that he developed with Drs. Art Pilla and Jack Ryaby....**Margo Oge** has become Director of the Office of Mobile Sources dealing with air pollution at the EPA, leaving open the position of Director of the Office of Radiation and Indoor Air. **Steve Page**, who has been running EPA's radon program, has been named acting director....Dr. **Michel Coleman**, the director of the U.K.'s Thames Cancer Registry, has been appointed professor of epidemiology and vital statistics at the London School of Hygiene and Tropical Medicine, effective next April. He will also hold the post of deputy chief medical statistician at the Office of Population Censuses and Surveys....Dr. **Patricia Buffler**, the dean of the School of Public Health at the University of California, Berkeley, has been elected a member of the national Institute of Medicine....**James Cunningham**, the former head of the public affairs department at the New York Power Authority (NYPA), has assumed the same position at the Long Island Lighting Co., better known as LILCO. And **Anne Strauss** of NYPA's department of public affairs has announced that she will retire in January....**Kenneth Griffing**, formerly of Southern California Edison Co., has joined NoRad's Field Management Services in Carson, CA, to work on active and passive mitigation techniques....**Larry Mansueti** has left the American Public Power Association to become the deputy director of the National Bioenergy Industries Association, also in Washington. **Curry Hagerty**, an attorney, is the new EMF contact at the APPA....Dr. **Jan Walleczek** has left Dr. **Ross Adey**'s lab in Loma Linda, CA, to work at the Department of Radiation Oncology at Stanford University's Medical School in Stanford, CA.

STANDARDS

EEA Plans To Classify EM Products... In its formal application to the American National Standards Institute (ANSI), the Electromagnetic Energy Association (EEA) states that it will develop radiation standards for specific products, includ-

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ing cellular phones and VDTs, based on general safety standards set by other organizations. Standards for cellular phones would rely on the 1992 ANSI/IEEE C95.1 guidelines but would be expressed in simpler terms—output power and current, for example, rather than field strength or SAR. Though the EEA's application is meant to be a generic one for setting up an accredited standards committee that could examine any product that emits electromagnetic radiation in the 0-300 GHz range, the EEA's description of the committee's scope makes specific reference to C95.1, which only covers 3 kHz-300 GHz. In a plan that has obvious applications to cellular phones, in particular, this section states: "Products that cannot produce exposures in excess of the provisions of ANSI/IEEE C95.1 during intended use will be designated 'Class 1' and will be exempt from all controls and warnings." Products that can produce exposures that exceed C95.1 will be designated Class 2 or Class 3 "based on the potential exposure of the user." For these, "appropriate controls, including user information, will be described." The proposed Accredited Standards Committee for Product Performance Relative to the Safe Use of Electromagnetic Energy will "serve the public interest by eliminating misunderstandings about the public health impact of certain electric/electronic products that use or generate electromagnetic energy," according to the application. The EEA announced last spring that it was reorganizing its activities and launching work on product performance standards (see *MWN,* M/J94). The deadline for comments on the application was November 30, and the EEA's executive director, Dinah McElfresh, said that "a handful" of comments had been submitted. Once the EEA responds to these, ANSI will rule on the application—probably next spring at the earliest, McElfresh said.

TECHNOLOGY

Microwave Light Bulbs... Fusion Lighting Inc. in Rockville, MD, with support from the DOE, has developed a lighting system for large commercial and industrial spaces that uses MW radiation to excite sulfur encased in a small quartz sphere. The MW generators are "very similar" to those used in MW ovens, according to Kirk Winkler, spokesperson for Fusion Lighting. But they are much more powerful. In a prototype installed at DOE headquarters in Washington, a pair of 5.9 kW MW generators illuminate golf ball-sized sulfur bulbs. The intense light from these two bulbs—the setup replaces 240 conventional 200 W mercury vapor street lamps—is then diffused through a 240-foot-long plastic tube, or "light pipe." A similar prototype is in use at the Smithsonian's National Air and Space Museum. Winkler noted that the company will do "whatever it takes to insure that there is no leakage" of MW radiation, but he said he could not provide more specific information about shielding until a commercial product is actually ready for market, which is at least a year away. The prototypes were developed with the help of a $2 million grant from the DOE, which is interested in the technology's energy-saving potential. The installation at DOE headquarters, for example, cuts energy consumption by 72%, according to the agency, while providing more light.

CLASSIFIEDS

MICRO WAVE NEWS

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Higher Leukemia Rates Among Those Living Near Australian TV Towers

Children who live in the shadow of television broadcast towers have higher rates of leukemia than those with homes further away from the antennas, according to a pilot study carried out in Sydney, Australia. The radiofrequency and microwave (RF/MW) radiation exposures implicated in the study are in the microwatt range—up to 1,000 times below many current RF/MW health standards.

"It's preliminary, it's tentative, it needs to be confirmed," said Dr. Bruce Hocking, a consultant on occupational medicine based in Melbourne, who led the study team. Nevertheless, he added, "It needs to be looked at in detail." He noted that the results have been submitted to a medical journal. Until early this year, Hocking was the chief medical officer at Australia Telecom, now renamed Telstra.

Between 1972 and 1990, children who lived in the communities closest to three broadcast towers, which house four TV stations and an FM radio station, had more than twice the rate of leukemia compared to similar children living some seven-and-a-half miles away. This is a statistically significant elevated risk. Most of the excess cancers were lymphatic leukemias. For adults the risk was smaller, though still significantly elevated. There was no increased incidence of brain tumors among those living near the TV towers.

(continued on p.16)

Swedish Government Endorses EMF Policy of Prudent Avoidance

On October 9, the five Swedish government agencies with responsibility for controlling human exposures to electromagnetic fields (EMFs) endorsed a policy of prudent avoidance.

The announcement accompanied the release of a long-awaited review by the Criteria Group for Physical Risk Factors, *Magnetic Fields and Cancer—A Criteria Document,* which concluded that, while "the scientific data base is insufficient to develop limits of exposures," this "does not exclude other steps to reduce exposure—based, e.g., on some form of strategy of caution." (A summary of the document appears on p.7.)

"Sweden is the first country to adopt, from a scientific viewpoint, the principle of prudent avoidance," Dr. Bengt Knave, the chair of the criteria group, told *Microwave News*. "This is a step forward." Knave is with the National Institute for Working Life (NIWL) in Solna.

In an interview, Dr. Kjell Hansson Mild of the NIWL in Umeå commented that, "All regulatory agencies now have the same strategy to address EMF exposures: prudent avoidance."

Some agencies—for instance, the National Electrical Safety Board (NESB)

(continued on p.6)

« The Talk of Palm Springs »

A number of those who came to Palm Springs, CA, for the annual review of EMF health research* had a copy of Dr. **Russel Reiter**'s and **Jo Robinson**'s new book, ***Melatonin: Your Body's Natural Wonder Drug*** (New York: Bantam, $22.95). Some even came with melatonin capsules to help them sleep.

The book features a chapter on EMFs, "The Elusive Enemy" (see p.14), which includes a section on the effects of electric blankets. Reiter and Robinson report that:

> In a study yet to be published, researchers measured the EMF exposure of 40 California women as they went about their daily routines. Some of the women happened to be electric blanket users. When they slept with their blankets turned on, their melatonin levels were as much as 50% lower than when they did not use the blankets.

They are referring to the ongoing study on the possible association between EMF exposures and miscarriages being carried out by Drs. **Gerri Lee** and **Raymond Neutra** of the California Department of Health in Berkeley. But after Lee and Neutra presented some preliminary findings at an Electric Power Research Institute (EPRI) workshop three years ago (*MWN,* J/A 92), neither has commented on the study results—and no details on melatonin have surfaced.

Reiter and Robinson credit a "personal communication" from Dr. **Bary Wilson** of the Battelle Labs in Richland, WA, as their source. But in Palm Springs, Wilson said he wasn't the source. And both Lee and Neutra said they weren't either. "It's a misunderstanding," Neutra said, "Reiter can't possibly have the results because *we* don't have them." And Lee explained why. "I haven't analyzed the data yet," she said. Unfortunately, Reiter was not at the DOE meeting to clear up the confusion.

«« »»

Drs. **Henry Lai** and **N.P. Singh** have found that 60 Hz magnetic fields can cause single-strand and double-strand breaks in the DNA of rat brain cells. The University of Washington, Seattle, researchers caused a stir in the cellular phone industry last year when they announced a similar effect following microwave radiation exposure (see p.9 and *MWN,* N/D94).

In Palm Springs, Lai reported statistically significant increases in single-strand breaks following a two-hour exposure at 1 G, 2.5 G and 5 G and in double-strand breaks at 2.5 G and at 5 G. For each type of DNA damage, they observed a dose-response relationship.

One confused utility representative asked what these results could mean—after all, he had long been told that power frequency EMFs are too weak to cause genetic damage. The answer, Lai later told *Microwave News,* is not that the EMFs cause the breaks, but that they may hinder DNA's natural repair mechanisms.

«« »»

Dr. **Maria Feychting** returned once more to the landmark results she and Dr. **Anders Ahlbom** reported in 1992 in order to address the persistent view that they had shown a link between childhood leukemia and distance from power lines—but not necessarily to magnetic fields (see p.5 and *MWN,* S/O92 and M/J94).

The difference is crucial because if separation distance is as reliable an indicator as magnetic field intensity, then distance may be a surrogate for something other than EMFs. Pesticides, perhaps, or some yet-to-be-determined variable—an elusive factor "X"—associated with transmission rights-of-way. Not so, reported Feychting. "There is no association with distance independent of historical calculations of magnetic fields," she said in Palm Springs.

Why are present-day measurements bad predictors of past leukemias? "Because the time interval between diagnosis and exposure measurement is important," Feychting answered.

In an interview, Feychting stressed that she does not believe that her latest results will settle this matter. But, she added, "Our study provides empirical support for the hypothesis that it is the magnetic fields that are of importance."

These results will appear in *Epidemiology* next spring.

«« »»

Amyotrophic lateral sclerosis (ALS), also known as Lou Gehrig's disease, is a neurodegenerative condition whose incidence has doubled in industrialized countries over the last 30 years—without explanation. In the 1980s, a study linked ALS to electrical occupations (see *MWN,* S/O86) and a few years ago a case of ALS was reported in a worker whose chair was located above a power transformer (see *MWN,* M/A92).

In Palm Springs, Drs. **Zoreh Davanipour** and **Eugene Sobel** of the University of Southern California medical school in Los Angeles, members of the group that published the case report, announced the results of a small-scale epidemiological study which concluded that, "occupational exposure to EMFs may increase the risk of ALS, particularly long-term exposure." Last year, Sobel reported a connection between EMFs and Alzheimer's disease (see *MWN,* J/A94 and J/A95).

Jordan Verdict Reversed

As we go to press, a new trial has been ordered in Larry and Nancy Jordan's cancer lawsuit against Georgia Power Co. and Oglethorpe Power Co. On November 30, the Third Division of the Georgia State Court of Appeals overturned a May 11, 1994, jury verdict in favor of the two utilities (see *MWN,* M/J94 and M/J95).

The appeals panel found that the trial judge had improperly allowed expert witnesses for the power companies to testify as to a "consensus in the scientific community" that EMFs could not cause non-Hodgkin's lymphoma, which Nancy Jordan had contracted in 1989. The court ruled that the companies' witnesses had not "clearly identified the 'community' of experts for which [they were] speaking," nor did they "precisely explain the method by which [they] ascertained the 'consensus.'"

---

* *Annual Review of Research on Biological Effects of Electric and Magnetic Fields from the Generation, Delivery and Use of Electricity,* Palm Springs, CA, DOE and EPRI, November 12-16.

Lawyer for Atlantic Electric Drops Case After Death Threats

The lead counsel defending Atlantic Electric Co. in an EMF cancer lawsuit has dropped out of the case after receiving a series of death threats. The New Jersey utility has charged that the threats came from the plaintiff in the case, John Altoonian of West Wildwood, NJ, and has asked that he be found in contempt of court. "I didn't do a thing," Altoonian responded in an interview. "They have no proof."

The trial date of Altoonian's lawsuit is scheduled for February 5, 1996. A hearing date on the contempt charges, which will be heard by a different judge, has not yet been set.

On October 9, attorney Gerald Corcoran found the outline of a tombstone spray-painted on the sidewalk in front of his law firm, Youngblood, Corcoran, Aleli, Lafferty & Stackhouse of Pleasantville, NJ. Within the tombstone was painted, "R.I.P., G. Corcoran, 11-1-95." On October 12, Atlantic Electric notified the court that Corcoran was withdrawing from the case and filed its motion for contempt.

Two days later, Tom Watson, an Atlantic Electric attorney who had filed the contempt motion, received the following letter at his home: "Hey motherf—er, I know where you work (nice place), I know where you live (f—in' dump), I know what you drive (nice car), I know where you go hunting (accidents happen), Don't worry your [sic] not going to die you are going to have pain and suffering beginning 11-1-95 so get the f— out of the EMF business." The unsigned letter was opened by Watson's wife, and included photos of Watson's office and the apartment building where he and his family live.

"I think it's prudent to take threats like that seriously," Watson said. "But I am not dropping out. I intend to try the case to verdict, and the threats are not going to deter me one bit from representing our client." Watson noted that 19 years ago he received similar threats while representing a group of Midwest utilities in a power line siting dispute, but had remained on the case. Asked which companies were involved, he answered, "I don't think they'd want it publicized."

Microwave News has learned that Watson, of the Washington firm of Crowell & Moring, is now accompanied by bodyguards. When asked for comment, Watson answered, "I never talk about security matters one way or the other."

Altoonian denied he was responsible for the anonymous threats, adding that he posed no danger to anyone: "I'm half dead, but I'm supposed to be this dangerous guy." He was diagnosed with chronic myelogenous leukemia (CML) in 1990, two years after moving into the home he built in West Wildwood. An underground 69 kV power line ran through his backyard, and, according to Altoonian, magnetic fields were as high as 300 mG in the yard, 60 mG on his deck, and 29 mG in his bedroom. In 1991 Altoonian filed suit against Atlantic Electric, which is based in Pleasantville, NJ, charging that EMFs from the line had caused his cancer. The utility moved the power line in 1992 (see *MWN,* N/D93, M/A94 and S/O94).

A heavy equipment operator who has been unable to work due to his illness, Altoonian is self-employed and without health insurance. This has made it impossible for him to afford a bone marrow transplant, which his doctors estimate would cost $300,000.

Besides alleging that Altoonian was responsible for the anonymous threats, Atlantic Electric has charged that he chased Corcoran at high speed down New Jersey's Garden State Parkway. On another occasion, according to the company's court papers, Corcoran was leaving an unrelated meeting of a local city council and found Altoonian waiting in a dark parking lot: "Altoonian silently raised his hand in a *gesture appearing to denote that he was holding a handgun...and pulling the trigger."*

"Not me. He's seeing things," said Altoonian, rejecting both allegations. "I drive on the Garden State Parkway all the time, but I never did that." He explained that he had gone to the city council meeting "to get some information on the beach erosion problem," and had seen Corcoran there. "What, I'm not allowed to go to a public meeting? When he tried to talk to me, I just ignored him."

Until the court ordered a stop to it, Altoonian had run ads in a local paper asking Atlantic Electric employees to get in touch with him if they had information relevant to his lawsuit. He says he faxed a copy of one of those ads to Corcoran, marking an ad for cemetery plots on the same page with the note, "I've got mine—how about you?" Altoonian insists that this signed note was "just a gesture" and not intended as a threat: "Everybody has to plan for death. I have to plan for it."

Also cited as a threat by Atlantic Electric is the following signed note, which Altoonian faxed to Corcoran: "In reply to your letter of June 27, 1995 to William Wolf [Altoonian's attorney]. I would like to educate you on the real meaning of the word *'harassment.'* When a strong healthy body is destroyed by radiation that is *'harassment.'* When I as a human being have had to suffer mental and physical pain for five years that is *'harassment.'*...Next week I will educate you on the meaning of the word *'threatening.'"*

The company obtained court orders twice this year barring Altoonian from communicating with its employees, specifically its lawyers.

Watson would not discuss how he intends to prove that Altoonian was behind the anonymous messages, explaining, "I don't think it's appropriate for me to preview the evidence before it's presented to the court." But the company's contempt motion argues for a link based on the date referred to in the mes-

Upcoming EMF Court Dates

• *Johsz vs. Koll* goes to trial on January 8. The case involves a cancer cluster in a real estate office above a set of Southern California Edison (SCE) transformers (see *MWN,* J/A94). *Younkin v. SCE,* a related case involving two other employees, has yet to be scheduled (see *MWN,* M/J95).

• Leonard Glazer's leukemia suit against Florida Power & Light Co., slated to begin October 23, was postponed until January 22 (see *MWN,* J/F94, M/J94 and S/O95).

• John Altoonian's lawsuit against Atlantic Electric is scheduled for trial on February 5.

sages: "November 1 is the day plaintiff John Altoonian filed his original complaint in this case in 1991." The motion also emphasizes that an anonymous letter received by Corcoran, warning, "Watson's going to get you F—ed Up Big Time," was mailed the day after a September 20 meeting at which the utility refused to offer any money towards an out-of-court settlement.

The contempt motion cites psychological reports describing Altoonian as "angry, sullen and depressed," with "possible signs of a burgeoning paranoid trend in his thinking." Altoonian's lawyer, William Wolf of Bathgate, Wegener, Dugan & Wolf in Lakewood, NJ, disputed the reports' relevance to the contempt charges: "Those are psychologists' reports that are part of our case with respect to possible damages that may be sought by the plaintiff." Wolf said that anyone in Altoonian's situation would experience some emotional strain: "I don't know how you even get up in the morning when you've got those kinds of problems."

Attorneys for the two sides have held three settlement meetings, but Watson said, "There have been no settlement offers by the defense." Asked if one was likely in the future, Watson answered that that would be his client's decision—"but if I were Altoonian, I wouldn't hold my breath."

Altoonian asserted that Corcoran had been paid $800,000 for his work on the case, and that Atlantic Electric was spending $31,000 a week to have him under full-time surveillance by private security guards—"more than enough money to take care of me." He argued that, "This could've been settled a long time ago. I would have had my operation and this all would've been over and done with." Atlantic Electric would not comment on its defense costs or on surveillance, and Corcoran did not answer repeated requests for an interview.

The suit had been scheduled to go to trial in April 1994, but has been repeatedly delayed. "They're trying to drag it out as long as they can," charged Altoonian. "They're hoping I'll die first. There should be some kind of statute, a certain period in which they're forced to go to trial." Watson responded that none of the delays had been requested by Atlantic Electric, and contended that they were in large part caused by difficulties in getting dates for the deposition of the plaintiff's expert witnesses. But Watson said he is treating the February 5 trial date as firm, and does not expect further delays.

Atlantic Legal Foundation: New Player on the EMF Scene

The Atlantic Legal Foundation (ALF) decided to take on the EMF issue to "prevent the introduction of bad science, or at least, if bad science is introduced, to mitigate its damage," according to Harvard University's Dr. Richard Wilson, a member of ALF's advisory council.

While ALF's *amicus* brief in the *Covalt* case was its first action on EMFs, this was not the first time it had dealt with science in the courtroom. An ALF brief was quoted by the U.S. Supreme Court in its *Daubert* decision, which imposed a more restrictive standard for the admissibility of scientific evidence. Other ALF legal actions have included opposing the shutdown of the Shoreham nuclear power plant on New York's Long Island, fighting restrictions on U.S companies doing business in South Africa, arguing against affirmative action programs and supporting drug testing of prospective employees.

ALF literature stresses "the foundation's deep commitment to redressing the bias against business which manifests itself in favor of narrow 'consumer' or 'environmental' concerns," and notes that the ALF "provides the counterbalance to narrow-interest groups by representing traditional American values."

The foundation's financial contributors include Chevron, Dow Chemical, Exxon, General Public Utilities, ITT, Kraft General Foods, New Jersey Bell, Pfizer, PSE&G, Texaco and Union Carbide.

"ALF intends to submit further *amicus* briefs in many cases to a variety of courts...[on] the relationship, if any, between 'EMF' and various diseases," wrote Wilson in an October 28 letter to the Duke Power Company Foundation. Written on stationery with the heading, "Harvard University Physics Department," the letter requested a contribution to the ALF and suggested an amount of $5,000 and up. The ALF brief in *Covalt* was described, and a copy of it was included. In closing, Wilson noted that, "The [Atlantic Legal] Foundation is always willing to discuss other issues where you think the foundation may be helpful."

Wilson told *Microwave News* that this fund-raising appeal was one of several similar letters: "We're writing to some utility people to see if they might be interested in contributing." He stressed that the foundation's legal work was entirely supported by donations from those who shared its goals. Edwin Selover, vice president and general counsel of the Public Service Electric & Gas Co. (PSE&G) in northern New Jersey, is also a member of ALF's Advisory Council.

Less than a month after filing its *Covalt* brief, the ALF organized a conference on EMFs in Philadelphia, co-sponsored by the Franklin Institute. In addition to Wilson, speakers at the October 19 meeting included Drs. Anders Ahlbom of the Karolinska Institute in Stockholm, Sweden, Philip Cole of the University of Alabama School of Public Health in Birmingham, and Kenneth Foster of the University of Pennsylvania, Philadelphia. "We set out to present a balanced picture by having scientists of different views," Martin Kaufman, ALF's general counsel, said in an interview.

The conference's final presentation was "Is 'Prudent Avoidance' Prudent?" by Dr. Edward Gerjuoy, a former physics professor at the University of Pittsburgh and now an attorney with the Pittsburgh firm of Rose, Schmidt, Hasley, & DiSalle. Attacks on the concept of prudent avoidance of EMF exposure have been increasingly prominent in the arguments of those who are skeptical about EMF health effects (see *MWN,* J/F95, M/J95, J/A95, S/O95), and were highlighted in the ALF brief in the *Covalt* case.

Skeptical Scientists Criticize California EMF Lawsuit

NO CANCER-EMF LINK FOUND, 14 SCIENTISTS TELL HIGH COURT and SCIENTISTS FIND NO EMF RISK. These were two of the newspaper headlines after a brief was filed with the California Supreme Court, arguing that "it is not scientifically reasonable to believe that 60 Hz magnetic fields increase the incidence of cancer." Of the document's 14 signers, six are Nobel Prize winners and most are physicists. The unsolicited brief reflects an increased willingness by those skeptical of EMF health effects to take action outside scientific circles.

The friend-of-the-court filing came in support of San Diego Gas & Electric Co. (SDG&E) in a lawsuit brought by Martin and Jean Covalt of San Clemente, CA. The Covalts charge that power lines near their home caused its value to decline (see *MWN,* M/A95 and M/J95). Several other *amicus* briefs have been filed in the case, including one submitted at SDG&E's request by the American Medical Association (AMA) and the California Medical Association (CMA).

The scientists' brief was an initiative of the Atlantic Legal Foundation (ALF), a conservative non-profit organization which has recently entered the EMF arena. "I was the one who got the group together," said Dr. Richard Wilson, a member of ALF's Advisory Council and a professor of physics at Harvard University in Cambridge, MA. An October 28 letter from Wilson to a utility company executive indicates that this brief is only the first of many EMF actions planned by the ALF (see p.4). ALF President Douglas Foster said in an interview that the foundation had decided on its own to intervene in *Covalt,* without any requests from SDG&E.

Wilson and the other signers of the ALF brief argue that those epidemiological studies finding an EMF–cancer connection have shown consistently low risk ratios—much smaller, for example, than those associated with smoking cigarettes. They then criticize the studies' statistical methodology, contending that even these relatively low-risk ratios are too high.

These scientists acknowledge that an association between power lines and a rise in childhood leukemia "has been repeated a few times, and there seems to be a consistent relationship with *proximity* to power lines, but not with the measured magnetic field itself" (see p.2). This, they state, "seems to many scientists to exonerate magnetic fields as the real cause of the leukemias found."

Those signing the ALF brief also emphasize inconsistencies in the types of cancer that have been linked to EMFs. Since one epidemiological study may find an increase in leukemia but not brain cancer, while another study finds the reverse, they hold that "these studies are *not* consistent and do *not* confirm each other." The idea that power line magnetic fields could cause cancer "violate[s] well-established laws of electromagnetism and thermodynamics," according to Wilson and the other 13 signers.

A reply brief from the Covalts' lawyer, Michael Withey of the Seattle firm of Schroeter, Goldmark & Bender, points out that the ALF argument is not endorsed by "a single epidemiologist," even though almost half of it is devoted to a discussion of "Hill's principles of epidemiology." Withey argues that, "The testimony in this brief would never be admitted into evidence, because these physicists are far outside the relevant [fields of] scientific inquiry, including epidemiology, biology, and biophysics." He calls the arguments in the ALF brief

Covalt Ruling Seen Unlikely To Include Personal Injury Cases

A few months ago, many observers thought that a broad Supreme Court ruling in the *Covalt* property devaluation case might end *all* EMF litigation in California—including personal injury suits. But such a sweeping decision now seems unlikely.

The state Supreme Court agreed to consider the case in May after an appeals panel ruled that the Covalts' lawsuit did not belong in court at all. The appellate decision held that their property devaluation claim fell under the jurisdiction of the California Public Utilities Commission (CPUC)—which has no legal authority to award damages.

Utility companies were quick to argue that the CPUC's authority covered not only property cases like the Covalts', but also EMF personal injury claims. Lower courts have issued contradictory rulings on the issue (see *MWN,* M/J95).

When Southern California Edison Co. (SCE) had such arguments rejected in the Younkin cancer suit, it appealed to the state Supreme Court to review both Younkin and the related Johsz case (see *MWN,* M/J95), and to establish the CPUC's jurisdiction over EMF claims of all kinds. But in June and again in August the Supreme Court rejected SCE's petitions, signaling that it will likely decide *Covalt* without addressing the personal injury issue.

"I think it's pretty clear that they were telling the Superior Court to go ahead, that they do have jurisdiction," said Annee Della Donna of Wylie Aitken in Santa Ana, CA, who represents plaintiffs in both *Younkin* and *Johsz*. "The issue of jurisdiction is so paramount that if they truly felt there was any question about it, they would have taken the case." A key factor, Della Donna told *Microwave News,* was probably the fact that the CPUC has no authority to award damages—"and in a personal injury case, that's all you can ask for."

SCE attorney Joel Lamp, of O'Connor, Cohn, Dillon & Barr in San Francisco, contended that the jurisdiction issue was still unresolved. "The Supreme Court denied review without any comment whatsoever," he said in an interview, calling Della Donna's view "pure speculation."

"Our position is that the Court of Appeal ruling applies even more strongly to personal injury cases than to property issues," Lamp explained. But he conceded that the Supreme Court may not address this argument in its ruling on *Covalt:* "We may have to go back to them with a personal injury case in the future."

Oral arguments in *Covalt* will be presented early next year, said Michael Withey, the plaintiffs' attorney.

"legally irrelevant and scientifically disputed."

Wilson told *Microwave News* that although his group had been accused of having only physicists, Drs. Rosalyn Yalow and Allan Cormack are both Nobel laureates in medicine. "There are no epidemiologists," Wilson conceded. "Of course, one reason was that the epidemiologists were either out of town or had a conflict of interest."

Withey's reply brief compares ALF's skepticism on EMF bioeffects to the arguments of the tobacco industry:

> The Tobacco Institute,...an offshoot of the Tobacco Research Council, questions "conventional wisdom" by focusing attention on a series of apparent "mysteries," the rhetorical force of which is to cast doubts on the connection between smoking and disease. [For example] why does lung cancer often occur "in the parts of the lung *least* exposed to smoke?"...The point...is to insinuate doubt, to reassure smokers, to stave off regulations....

Withey also contrasts the conclusions in the ALF brief with those in the recent draft report of the National Council on Radiation Protection and Measurements (NCRP) committee on EMFs (see *MWN,* J/A95), which cites accumulating evidence of a link between EMFs and cancer. The members of this committee, he writes, "are experts within the relevant fields of bioelectromagnetics, epidemiology and biophysics."

The Covalts' lawsuit does not seek to prove that EMFs are harmful—only that SDG&E's power lines have caused the Covalts to suffer financially, due to public concerns that EMFs *may* pose a danger. This point is the focus of an *amicus* brief filed in support of SDG&E by the AMA and the CMA.

The medical associations stress "the importance of relying on sound scientific knowledge in any case involving health concerns," and argue that, "There can only be harm to society when uncorroborated, inaccurate and/or unproven beliefs which fuel public fear become institutionalized in precedential court rulings." They highlight the AMA's conclusion that "no scientifically documented health risk has been associated with the usually occurring levels of EMFs" (see *MWN,* J/A95).

While Withey's reply brief explicitly states that "the Covalts' lawsuit does not depend upon evidence that EMFs are hazardous to health," it does seek to link changes in the real estate market with the existence of a real possibility that a health hazard could exist. Withey argues that it is unrealistic to delay all property damage claims until every scientific uncertainty is resolved.

The concept of "fair market value," he explains, is based on "a hypothetical prospective buyer 'with full knowledge' of all uses and purposes of the property." To reject the Covalts' claim, he contends, means that "a buyer with 'full knowledge' of EMFs...cannot *as a matter of law* [his emphasis] be legitimately concerned that such elevated EMFs might cause the buyer to have an increased risk of cancer," or that their investment may lose value if researchers find more evidence supporting an EMF-cancer connection. According to Withey, "This argument defies rationality."

Scientists Critical of Covalt Suit

The Atlantic Legal Foundation's *amicus* brief in the *Covalt* case was signed by the following: Drs. Robert Adair, Yale University, New Haven, CT; Nicholaas Bloembergen,* Harvard University (emeritus), Cambridge, MA; David Bodansky, University of Washington (emeritus), Seattle; Allan Cormack,* Tufts University (emeritus), Medford, MA; Walter Gilbert,* Harvard; Sheldon Lee Glashow,* Harvard; David Hafemeister, California State Polytechnic University, San Luis Obispo; Col. James Merritt, Armstrong Laboratory, Brooks Air Force Base, TX; John Moulder, Medical College of Wisconsin, Milwaukee; Robert Park, University of Maryland, College Park; Robert Pound, Harvard (emeritus); Glenn Seaborg,* (emeritus) University of California, Berkeley; Richard Wilson, Harvard; and Rosalyn Yalow,* Bronx VA Medical Center (emeritus), New York City. *(* = Nobel laureate)*

Sweden Endorses Prudent Avoidance *(continued from p.1)*

—have been advocating prudent avoidance for some time (see *MWN,* S/O92, M/J93, J/F94, M/J94 and J/F95).

Rolf Lindgren, the EMF manager at Vattenfall, the state power company, in Göteborg, commented that, "Personally, I agree with these recommendations—it's prudent."

When asked what data would be needed to set exposure standards, Knave replied: "There still needs to be some replication of the epidemiological studies and more information on mechanisms." Knave pointed out that different forms of leukemia show up in epidemiological studies. "Why can't we have some similar results?" he said.

"If similar studies continue to show an EMF link to Alzheimer's disease, ALS [amyotrophic lateral sclerosis], EMF sensitivity and breast cancer," Knave added, "this will increase the burden to set standards."

In a series of interviews, a number of Swedish scientists and regulators commented that it is practically impossible to site a power line next to a school or a playground in their country.

Three other Swedish reports were also released on October 9. A team led by Dr. Lennart Hardell of the Department of Oncology at the Örebro Medical Center in Örebro, has published a detailed 107-page evaluation of the EMF–cancer data as a supplement to the *European Journal of Cancer Prevention.* This team, which includes Drs. Bo Holmberg of the NIWL and Lars-Erik Paulsson of the Swedish Radiation Protection Institute (RPI) in Stockholm, agreed with Knave's group that there is "no scientific basis" for EMF standards, but they did point out that there are a number of "possible associations" between various types of cancer and exposures to EMFs (see p.7).

In addition, Knave's criteria group issued a second report on approaches to standard setting and NIWL's Dr. Ulf Bergqvist, who served as the secretary of the criteria group, released his own review of the epidemiological studies on occupational EMF exposures and cancer. Bergqvist concluded that, "despite the comparatively high degree of credibility that can be given positive findings in some studies," the association between EMFs and cancer has not been shown "beyond reasonable doubt."

The five Swedish agencies that endorsed a policy of prudent avoidance are: the National Board of Housing, Building and Planning; the National Electrical Safety Board; the NIWL; the RPI; and the National Board of Health and Welfare.

Swedish Abstracts

"Epidemiological and experimental studies concerning extremely low frequency electromagnetic field exposure and malignant diseases published up to July 1, 1994, were evaluated to assess the possible carcinogenicity of electromagnetic fields and the scientific basis for environmental and occupational standard setting. We concluded that there are possible associations between (i) an increased risk of leukemia in children and the existence of, or distance to, power lines in the vicinity of their residence, (ii) an increased risk of chronic lymphatic leukemia and occupational exposure to low frequency electromagnetic fields and (iii) an increased risk of breast cancer, malignant melanoma of the skin, nervous system tumors, non-Hodgkin's lymphoma, acute lymphatic leukemia or acute myeloid leukemia and certain occupations. There is no scientific basis for occupational or environmental standard setting for low-frequency electric or magnetic fields."

Lennart Hardell et al., "Exposure to Extremely Low Frequency Electromagnetic Fields and the Risk of Malignant Diseases—An Evaluation of Epidemiological and Experimental Findings," **European Journal of Cancer Prevention,** Vol.4 (Supplement 1), *September 1995, 107 pp. Copies are available for £29.50 (approx. $44.25), plus £2.50 (approx. $3.75) for postage and handling. Contact: Julie Gribben, Sales Administrator, Rapid Science Publishers, The Old Malthouse, Paradise St., Oxford OX1 1LD, U.K., (44+1865) 790447, Fax: (44+1865) 344012.*

"This document summarizes certain issues concerning whether scientific support exists for developing limits of exposures for occupational exposure to low-frequency magnetic fields. Effects under discussion in the document are certain forms of leukemia and brain tumors. There is a lack of knowledge concerning the relevant exposure measure for a possible association between magnetic fields and biological effects. Based on performed epidemiological studies, the discussion is centered on the external exposure in terms of average exposure in ∝T during a certain time period, or in terms of accumulated exposure during a number of years. The Criteria Group for Physical Risk Factors notes that animal experiments do not give sufficient support for a relationship between cancer and exposure to magnetic fields. Epidemiological studies show a certain, credible but weak, support for the hypothesis of an association between brain tumors and certain forms of leukemia and magnetic field exposure. An overall evaluation of both animal and epidemiological studies is that occupational exposure could possibly be a human carcinogen. There is, however, a lack of data to determine whether a dose–response relationship exists. The Criteria Group summarizes the situation such that the scientific data base is insufficient to develop limits of exposures. This does not exclude other steps to reduce exposure—based, e.g., on some form of strategy of caution."

The Criteria Group for Physical Risk Factors, "Magnetic Fields and Cancer—A Criteria Document," **Arbete och Hälsa,** No.13, *1995, pp.1-10. See also, "Evaluations Made When Developing a Scientific Basis for Limitations of Exposures,"* **Arbete och Hälsa,** No.12, *1995, pp.1-18. (Both reports are in Swedish.)*

"Eight epidemiological studies of occupational exposure to low frequency magnetic fields and cancer were reviewed—with exposure estimates based on actual measurements at relevant workplaces. The review was supplemented by some studies where exposure estimates were derived in other manners. In conclusion, we find—despite the comparatively high degree of credibility that can be given positive findings in some studies—that the results of these studies have not, with sufficient degree of certainty, shown that occupational exposure to extremely low frequency magnetic fields is associated with cancer. Thus, such associations have not been shown 'beyond reasonable doubt.'"

Ulf Bergqvist, "Epidemiological Studies of Possible Associations Between Occupational Exposure to Magnetic Fields and Cancer—A Review," **Arbete och Hälsa,** No.11, *1995, pp.1-26 (in Swedish).*

HIGHLIGHTS

« Cellular Phone Notes »

Experiments by Dr. **Peter Semm** of **German Telekom** in Darmstadt show that 60% of the cells in the avian brain will respond to a relatively weak microwave signal. Speaking at a November 12 workshop on *Sensory Perception of Magnetic Fields,* organized by the Department of Energy in Palm Springs, CA, Semm said he can observe "a very clear response in the cells of the central nervous system of birds" following an exposure to 100 ∝W/cm^2. He thinks it is unlikely that humans are similarly influenced because, if so, he believes they would feel it. Semm speculated that healthy human brains, which are more highly developed than those of birds, can compensate for such exposures, though he is less sure whether older subjects could do so as effectively. In general, according to Semm, it is not the high frequency microwave radiation that is biologically relevant, but the pulsing of the signal. He also remarked that he has been investigating this phenomenon for two years but had hesitated to publish his findings. "The technique is complicated and therefore there is an opportunity for artifacts," he explained.

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CTIA's research group, **WTR**, has awarded a two-year grant of approximately $300,000 to Dr. **Kenneth Foster** of the University of Pennsylvania in Philadelphia for an evaluation of different ways of analyzing how the head absorbs radiation from a hand-held cellular phone. WTR will purchase a measurement system from Dr. **Niels Kuster**'s lab at the Swiss Federal Institute of Technology in Zurich for Foster's use. "It consists of an elaborate robot-controlled device for moving a field probe around a human-shaped tank filled with phantom material—that is, liquid whose electrical properties are similar to those of tissue at microwave frequencies," Foster told

Do Cellular Phones Cause Headaches?

Not long ago, anyone who complained about getting a headache after using a cellular phone was dismissed as loopy. No longer. A growing number of reports of migraines and other types of headaches is prompting researchers from around the world to take this possible link seriously.

"Using my mobile phone for short periods—2-3 minutes—makes me feel dizzy; using it for more than 15 minutes gives me a headache," wrote Dr. Paul Jackson of Winchester, U.K., in a message to *EMF-Link,* a World Wide Web site on the Internet run by Information Ventures in Philadelphia (http://infoventures.com). Jackson has a doctorate in chemical engineering and works as training manager in information technology.

Another note to *EMF-Link* read in part "I began experiencing headaches, one or two a day, since I began using my new cellular phone on October 2, 1995....I hold the phone on the left side of my head and the headaches are occurring on the same side. Most of my headaches seem to begin while I am sleeping during the night as I wake up with it."

Such complaints have caught the interest of Dr. Robin Cox, a consultant on occupational health to a number of telecommunications companies and to the British Electricity Association. Cox, who is based in London, U.K., has come across five to ten cases. "A number of people including myself have become aware of those who claim to have headaches associated with the use of mobile phones," he told *Microwave News.* "We ought to look into it to determine whether there is a real association." Cox is the former chief medical officer of the U.K. Central Electricity Generating Board, which has been broken up into a number of privatized electrical utilities.

Dr. Bruce Hocking, an occupational medicine consultant in Melbourne, Australia, echoed Cox's concerns. "I am aware of several cases of headaches among cell phone users and, interestingly, many of these people said they don't usually get headaches," he said in an interview. He added that he too would like to know whether there is any substance to such claims. Until early this year, Hocking was the chief medical officer of Australia Telecom (now called Telstra).

In Sweden, Dr. Kjell Hansson Mild of the National Institute of Working Life in Umeå, said that he had heard of approximately 30 cases. "It's much easier to believe that there are subjective disorders like headaches than that there are cancers," he told *Microwave News.* "They could be related to the electromagnetic hypersensitivity problem." Mild is a member of the newly established EC expert group on the safety of mobile phones (see p.9).

The new GSM cellular phones that emit pulsed modulated signals are more likely to cause headaches than the older Nordic analog system, known as NMT, according to Clas Tegenfeldt, an electrical engineer at Linköping University in Linköping, Sweden. Jackson, however, reported that he got headaches whether he used a digital or an analog phone.

In the U.S., Dr. Gregory Lotz, the chief of the Physical Agents Effects Branch at the National Institute for Occupational Safety and Health (NIOSH) in Cincinnati, stated that his agency has not had any inquiries about headaches associated with cell phones. "NIOSH continues to monitor research on the issue," he said in an interview.

Microwave News. "The problem is to determine the best way of measuring the specific absorption rates," he explained. One option is to use a physical model like Kuster's, which Foster called "a very nice phantom of the head." Alternatively, he said, "You can do very accurate calculations as Om Gandhi has done." Foster added, "I'll be doing experimental work with Kuster's system to see if we can get a better picture of the accuracy of present techniques, and if possible make them more accurate. The present techniques seem to work pretty well, but there are some questions about how accurate they really are for a person actually using a cellular phone." Some results may be released before the end of the project. "This validation work is an ongoing process," Foster noted. He will be collaborating with WTR's Dr. Bill Guy in Seattle and with Dr. Om Gandhi's team at the University of Utah, Salt Lake City (see *MWN,* J/F94 and S/O94).

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The Georgia Court of Appeals will consider the dismissal of a brain cancer lawsuit brought by **Richard Ward** against **Motorola**. On September 18, after the trial judge rejected Motorola's motion to dismiss the case for lack of evidence (see *MWN,* S/O 95), the cellular phone maker asked the appellate court to overturn the ruling. Motorola's request was denied October 5 on the grounds that it had been filed too late. But five days later the Court of Appeals reversed itself, saying that Motorola had been a victim of a "clerical error." Motorola spokesperson Norman Sandler, in Schaumburg, IL, told *Microwave News,* "We're gratified the appeal was accepted," and called the lawsuit "baseless." Ward's attorney, William Gray of the Atlanta firm of Dennis, Corry, Porter & Gray, does not expect the case to be settled quickly. "If we get out of the Court of Appeals within six months," he said in an interview, "we'll be on the fast track. We're quite a ways from getting this resolved."

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WTR has awarded three research grants for work on electromagnetic interference (EMI) between portable cellular telephones and implantable cardiac pacemakers. Dr. **Mark Estes** of the New England Medical Center in Boston received $105,000, Dr. **David Hayes** of the Mayo Clinic in Rochester, MN, got $110,000 and Dr. **Dwight Reynolds** of the University of Oklahoma Health Sciences Center in Oklahoma City was given $138,000. Last May, when WTR first announced this initia-

tive, its spokesperson Mike Volpe had said that WTR's pacemaker study would be conducted by Hayes, Dr. **Roger Carrillo** of Mt. Sinai Medical Center in Miami Beach and Dr. **Hans Moore** of George Washington University (GWU) (see *MWN,* M/J95). "Mount Sinai, the Mayo Clinic and GWU have all been officially approved to carry out work described in the [pacemaker research] protocol," Volpe told *Microwave News* at that time. "In our view, the work has already begun," he added, although "the contracts technically have not been signed." WTR's October newsletter, which announced the three pacemaker grants, stated that, "WTR has identified Dr. Hans Moore of the GWU Medical Center, Washington, DC, to conduct a clinical study investigating interference between cellular telephones and implanted defibrillators." It gave no further details, and Carrillo was not mentioned. When asked about the change in Carrillo's role, Volpe answered that he had been invited to serve as clinical liaison to a WTR advisory committee, but had not yet responded. Carrillo declined to comment.

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WTR's expert panel on the single cell gel (SCG) assay—also known as the "comet assay"—has endorsed the procedure for use in studying effects of RF/MW exposure on DNA. Last year, when Drs. **Henry Lai** and **N.P. Singh** of the University of Washington, Seattle, reported that low levels of RF/MW exposure caused an increase in single-strand breaks in the DNA of the brain cells of rats, some in the cellular phone industry questioned whether the comet assay was a reliable technique. For instance, WTR's Dr. Ian Munro of CanTox in Mississauga, Canada, said, "We are not sure it is producing a valid result" (see *MWN,* N/D94). WTR now reports that its expert panel, organized in October 1994, has concluded that use of the alkaline SCG assay is appropriate "due to its sensitivity." The assay is not specific to single-strand breaks, but rather "measures a range of DNA damage," panel member Dr. **Ray Tice** of Integrated Laboratory Systems in Research Triangle Park, NC, said in an interview. "When you're running the DNA out in the gel," Tice explained, "the smaller it is, the further it runs. And there are types of DNA damage besides single-strand breaks that can cause that migration." This, he continued, was actually an advantage: "It's a useful tool *because* of the fact that it's more generic." Tice is also one of the coordinators of an international validation study of the SCG assay that will probably not be completed for a couple of years. Some members of the Harvard Center for Risk Analysis cellular telephone advisory committee had argued that attempts to replicate the Lai-Singh experiment should wait until that international effort was completed (see *MWN,* M/A95). Tice said that the international evaluation had to look at a wider variety of possible uses for the assay, and that if WTR had opted to wait for its completion, "they would probably be considered overly cautious." On hearing of the WTR panel's conclusion, Lai told *Microwave News,* "I am happy they have accepted the assay for studying RF mutagenesis."

EC Seeks Plan for Mobile Phone Health Research Program

The European Commission (EC), with the backing of the European Parliament, has established an expert group to prepare a "blueprint for a comprehensive action plan for research into the possible effects of mobile telecommunications on human health." Dr. Alastair McKinlay, the head of the non-ionizing radiation department at the U.K. National Radiological Protection Board in Chilton, Oxfordshire, is the chair of the group.

A decision has not yet been made as to whether the research plan will be implemented. The areas to be covered include bioeffects, dosimetry, epidemiology and mechanisms of interaction.

The research plan is due to be completed by July 31, 1996, McKinlay told *Microwave News.* The group plans to hold two meetings in December and another in January. McKinlay added that his expert group will also recommend "a structure for funding that allows industry to contribute to the research program, but clearly and demonstrably separates them from the research being carried out—in essence the construction of an administrative fire wall between the funding source and the researchers."

McKinlay is also a member of the International Committee on Wireless Communication Health Research (ICWCHR). But, he said, the two efforts are "entirely separate." Dr. Jørgen Bach Andersen of the Center for Personkommunikation at Denmark's Aalborg University is also a member of both the EC group and the ICWCHR.

Earlier this year, Andersen prepared a report for the EC concluding that more health research is needed (see *MWN,* S/O95).

The ICWCHR was set up by Dr. George Carlo of Wireless Technology Research (WTR), based in Washington, which is sponsored by the U.S. cellular phone industry. The WTR and ICWCHR sponsored a *State of the Science Colloquium* in Rome, Italy, November 13-15 (see *MWN,* S/O95).

Part of the impetus for the European research program is the increasing concern over the health and safety of mobile phones and personal communication devices as well as the growing opposition to the siting of communication towers in urban areas. In its October 3 announcement, the EC, which has its headquarters in Brussels, Belgium, predicted that, in certain European markets "more than 50% of all telephone accesses will be wireless by as early as the year 2000."

Sweden's Dr. Kjell Hansson Mild, a member of McKinlay's committee, explained that the EC believes "the communities of tomorrow will be using mobile phones, so the objective is to stop the hindrances to the development of this technology."

With respect to the possible health impacts of this technology, the EC said: "While the thermal effects of exposure to [RF] energy are relatively well-known, there is a lively debate as regards the athermal effects, for which, however, no convincing adverse effect has been demonstrated." Nevertheless Mild, who is with the National Institute for Working Life in Umeå, commented that, "It will not be easy to settle the bioeffects

problem in the short term."

In addition to Andersen, McKinlay and Mild, the other members of the expert group are: Drs. Jürgen Bernhardt, Institute for Radiation Hygiene, Neuherberg, Germany; Martino Grandolfo, National Institute of Health, Rome, Italy; Konstantin Hossmann, Max Planck Institute for Neurological Research, Köln, Germany; Anthony Swerdlow, London School of Hygiene and Tropical Medicine, U.K.; Flora van Leeuwen, The Netherlands Cancer Institute, Amsterdam; Luc Verschaeve, Flemish Technological Research Institute (VITO), Brussels, Belgium; and Bernard Veyret, University of Bordeaux, France.

Rooftop Cellular Antennas Pose Localized Health Risks

Workers who come close to roof-mounted cellular antennas may be exposed to RF/MW radiation levels which exceed current occupational safety guidelines, according to a new report* prepared for the Federal Communications Commission (FCC) by Richard Tell of Richard Tell Associates Inc. in Las Vegas.

Roof-mounted cellular antennas use relatively low power and therefore do not entail "significant" exposures to those who are on the ground at the base of the tower, Tell found. But he added that a worker standing near such antennas could be exposed to much higher levels.

Tell stressed in his report that, "The issue of neighborhood exposure in the vicinity of cellular base stations is irrelevant to any consideration of compliance with applicable guidelines for safety because of the minuscule levels." In an interview with *Microwave News,* Tell said that he has no concerns over school-mounted antennas, except in cases in which the rooftops are accessible.

"It's clear that on some rooftops there is a potential for RF/MW levels to exceed the controlled and uncontrolled limits in the 1992 ANSI/IEEE standard," Tell said. The 1992 standard specifies two types of exposures: "controlled" for environments where those exposed are assumed to be aware of the risks, and "uncontrolled" for environments where they are assumed to be unaware (see *MWN,* N/D91 and N/D92).

"It is common to have other types of communication antennas nearby such as paging and two-way radios," Tell added. He pointed out that paging antennas with power outputs of 500 W are becoming commonplace on rooftops. "What the industry should be looking at is dense, roof communication sites, especially rooftops which have public access," Tell said. "The sticky side of this issue comes up when a building manager has to decide whether a roof is a controlled environment. If so, warning signs would have to be used to alert electricians, roof repairers, air conditioning mechanics and any others who might work nearby," he added.

The FCC is currently considering adopting the 1992 ANSI/IEEE standard. According to Tell, its decision may be influenced by the distinction between controlled and uncontrolled environments—instead of the more common dichotomy between occupational and public exposures. Although cellular telephone antennas are now exempt from FCC RF/MW guidelines due to their low power (see *MWN,* Ap85 and M/A87), Tell points out in his report that this may change: "Even though present FCC regulations categorically exclude cellular facilities from certifying that they comply with RF radiation rules used for most other regulated services, the FCC is presently reconsidering this position, mainly driven by concerns over possible worker exposure to strong RF fields..."

In his report, Tell estimated a maximum "keep-out" distance of about 18-20 feet for a cellular phone installation with 30 active, 100 W channels. Tell explained that although keep-out distances, which bracket areas exceeding the 1992 standard, do not necessarily indicate a hazard, they do suggest the potential for overexposure. He pointed out that in cases where the antenna is situated high above the roof, the keep-out distances are smaller because the power density falls rapidly with distance. Reflections from roofing materials are included in Tell's estimates since they can increase the power levels.

Tell's results are consistent with those presented in an earlier study by Ronald Petersen and Paul Testagrossa of AT&T

Osepchuk Becomes Chairman of ANSI/IEEE Standards Group

Dr. John Osepchuk is the new chairman of Standards Coordinating Committee 28 (SCC28) on Non-Ionizing Radiation, the group that developed the 1992 ANSI/IEEE RF/MW exposure standard. SCC28 is sponsored by the Institute of Electric and Electronic Engineers (IEEE) Standards Board.

Osepchuk, who is based in Concord, MA, recently retired after a long career at Raytheon Co. He replaces Dr. Tom Budinger of the University of California, Berkeley, who stepped down last year.

Ronald Petersen of AT&T Bell Labs in Murray Hill, NJ, has taken over Osepchuk's past duties as SCC28's executive secretary. Dr. Eleanor Adair of the John Pierce Laboratory in New Haven, CT, is the new vice chair of the committee. She replaces Dr. Bill Guy, an emeritus professor at the University of Washington, Seattle, and now a member of WTR.

Adair was previously cochair—with Dr. Om Gandhi of the University of Utah, Salt Lake City—of SCC28's Subcommittee 4, which drafted the 1992 standard. Dr. John D'Andrea of the Naval Medical Research Institute at Brooks Air Force Base, TX, is the new cochair of the subcommittee.

In a further change, Subcommittee 2 has a new name: "RF Control Measures and Hazard Communications." The old name was simply "Terminology and Units of Measurements." Richard Tell, a consultant based in Las Vegas, who is the chair of Subcommittee 2, said that he is planning to generate a guidance document on how to set up an RF safety program.

Next October, the IEEE will hold a workshop on how to apply the 1992 RF/MW standard. (See p.16 for details.)

Bell Labs in Murray Hill, NJ,† and in another by Dr. Robert Cleveland and coworkers at the FCC and Edwin Mantiply of the Environmental Protection Agency.‡

* Richard Tell, ***Engineering Services for Measurement and Analysis of Radiofrequency (RF) Fields*** (FCC Report No. OET/RTA 95-01), June 1, 1995, 159 pp. (No. PB95-253829). Order from: National Technical Information Service, Springfield, VA, (800) 553-6847.

† R. Petersen and P. Testagrossa, "Radiofrequency Electromagnetic Fields Associated with Cellular-Radio Cell-Site Antennas," ***Bioelectromagnetics,*** *13,* pp.527-542, 1992.

‡ R. Cleveland, et al. ***Measurement of Radiofrequency Fields and Potential Exposure from Land-Mobile Paging and Cellular Radio Base Station Antennas,*** Abstract No. P-36C, *17th Annual Meeting of the Bioelectromagnetics Society,* Boston, MA, June 18-22, 1995.

California PUC Advises Against Cellular Antennas Near Schools and Hospitals

The California Public Utilities Commission (CPUC) has urged cellular telephone companies to avoid building their towers near schools and hospitals. The November 8 recommendation counsels that these sites should be used only as a last resort. The commission, which is based in San Francisco, did not endorse specific limits for exposures to radiofrequency and microwave (RF/MW) radiation. Nor did it adopt a staff recommendation that called for restricting access to cellular towers by use of warning signs or physical barriers.

The CPUC opinion was unexpected and caught most observers by surprise. On learning of the decision, Dr. Raymond Neutra, acting chief of the California EMF Program in Emeryville, told *Microwave News* that it "seems like a very reasonable approach to the issue."

Stephen Carlson, executive director of the Sacramento-based Cellular Carriers Association of California, did not respond to repeated requests for comment.

The siting of cellular phone antennas on school property has long been a contentious issue. While school districts are attracted by the rents paid by communications companies, they must also answer to parents and teachers who are concerned about the possible ill effects of chronic exposure to RF/MW radiation. With more than 1,000 cellular towers in California, 10,000 across the country and 100,000 expected in the U.S. in the next 10 years (see p.14 and *MWN,* M/J95), numerous confrontations between companies and activists have erupted (see p.12 and *MWN,* N/D93) and will no doubt continue.

Each side has had its share of victories. One significant turning point came in 1993, when the San Francisco school board prohibited a mobile communications company from placing an RF transmitter on top of a high school, a decision based in part on a recommendation from Neutra (see *MWN,* N/D93).

"Public perception about potential health problems will continue to exist as long as there remain unanswered and unexplored questions in the scientific community on the EMF and RF radiation issue," the CPUC concluded. The commission's opinion follows a December 1993 report from its Commission Advisory and Compliance Division (CACD), based on a July 1993 workshop held in San Francisco. The CACD had recommended that, "Until clearer answers emerge, the commission should consider the possibilities that a health hazard could exist."

In an effort to keep itself and other interested parties apprised of significant developments that may require action in the future, the commission agreed that the CACD should be a "storehouse" of the latest RF/MW research results. And it ordered the CACD to hold informal RF/MW workshops as additional health information becomes available.

The decision of the CPUC noted that, "Scientific studies have not indicated any obvious relationship between prolonged lower-level RF radiation exposure and increased mortality or morbidity, including cancer." The CACD had observed that there is even less data on the health effects of RF exposure than on EMFs, and both the commission and the CACD felt that it would be "premature" to adopt specific RF exposure standards at this time.

But precisely because "very little is known about possible health hazards associated with EMF and RF exposure levels," the CPUC decided that it should take some interim measures. It voted to adopt the CACD report and almost all of its recommendations.

The one exception was a CACD recommendation that cellular companies "be encouraged to restrict access to cell sites by use of warning signs or physical barriers such as fences," a measure which the CPUC declined to endorse. The commission pointed out that cellular utilities are already required to address public concerns about potential health problems from EMF and RF radiation associated with the construction of new cell sites as part of the environmental review process under General Order 159 and that most towers are already inaccessible. General Order 159 is currently undergoing revision and cellular utilities will be expected to implement any revised requirements.

The CACD report observed that, although the "economic considerations of this issue are significant," the health and safety of the public was "equally, if not more, important." Diana Brooks of the CPUC's Division of Ratepayer Advocates commented that, "I believe the CPUC's interim measures are an attempt to balance important economic considerations with crucial public health and safety concerns."

Local governments are likely to be influenced by the CPUC's position. The CACD report noted that, "explosive growth of cellular base stations or cell sites throughout California has placed the issue squarely on the shoulders of local governments, which are responsible for granting use and construction approval....Due to public pressure from various communities to [prevent] cellular companies from constructing more sites, local governments are looking to the commission for more leadership on this issue."

The CPUC's decision noted that "siting cells close to schools

or hospitals often raise[s] local opposition based on a perception of health risks," and stated that utilities should address public health concerns. The CACD report expressed the hope that, "These steps may demonstrate to the public that the industry is willing to accommodate public concern, which may result in greater cooperation in the construction of future cell sites."

But the cellular phone industry has become impatient with restrictions on tower siting and is trying to preempt local siting decisions. Amendments have been added to the U.S. Congress' pending overhaul of communications law that would prevent state and local RF safety regulations from being more stringent than federal standards (see *MWN,* M/J95).

Similarly, in December 1994, the Electromagnetic Energy Association (EEA) and the Cellular Telecommunications Industry Association (CTIA) petitioned the Federal Communications Commission to preempt state and local regulations for licensing cellular phone towers (see *MWN,* J/F95). In August 1995, the industry won a tactical victory when President Clinton ordered the heads of all federal agencies to facilitate the use of government property for locating cellular antennas (see *MWN,* S/O95).

While no mandatory restrictions are imposed by the CPUC decision, it is likely to have a significant impact. Cellular companies that are perceived as being uncooperative could be pressured through the CPUC's substantial regulatory authority. For example, last February, the commission fined the Los Angeles Cellular Telephone Co. $4.37 million for filing false information regarding 150 of its cellular facilities (see *MWN,* M/A95).

Opposition to Communication Towers on the Rise in the U.S. and Around the World

As cellular phone and personal communications services (PCS) companies seek to expand their coverage, communities in the U.S. and around the world continue to fight to keep antennas out of their neighborhoods (see *MWN,* N/D93, M/J95 and S/O95):

• On November 21, 1995, New York's Supreme Court (the state's lowest court) affirmed the right of the town of Harrison in Westchester County to impose a 90-day moratorium on the building of cellular towers, pending the development of appropriate zoning regulations. In his decision involving Cellular One, Judge James Cowhey ruled that, "The moratorium at issue constituted a reasonable measure designed to give the town a short period of time in which to enact zoning changes to rationally meet the need to address the increasing number of cellular telephone antenna facility applications." He noted that Harrison's action "is not based upon any perceived health risks on the part of the community." In nearby Tarrytown, a moratorium on cellular towers based on public perception of a health impact had been previously overturned.

• In Washington state, Governor Mike Lowry has set up a Telecommunications Policy Coordination Task Force to address antenna siting and other issues. Citizens' groups in many parts of the state have blocked construction of cellular installations. For instance, on Bainbridge Island, residents persuaded the city council to block a cellular tower, contending that it was "out of scale" with the surrounding neighborhood, according to the November 18 *Bainbridge Review.* Citizens' groups in Edmonds and Poulsbo, two other towns in Washington state, have also successfully fought cellular tower construction in their backyards.

• San Francisco residents presented arguments against Pacific Telesis' proposed construction of nearly 200 PCS antennas at a November 30 hearing of the San Francisco Planning Commission. According to Daniel Zoll's article in the *San Francisco Bay Guardian* of December 6, "Neighbors expressed frustration over the city's haphazard permit process for the installation of cellular antennas and transmitters, as well as its lack of a comprehensive telecommunications plan." Dr. Jerrold Bushberg of the University of California, Davis, reassured the public on behalf of Pacific Telesis. The hearing is scheduled to resume on December 14.

• At the request of the Policemen's Benevolent Association Local 36, Clifton, NJ, city officials and the Passaic County Board of Health will be conducting an investigation into possible health effects of a radio antenna. According to the September 24 *Dateline Journal,* the request was sparked by six police officers who were diagnosed with cancer. The paper reported that all six worked about 30 feet from the tower. Last year, a school in Clifton was the site of an intense EMF controversy (see *MWN,* M/A94).

• Telstra, Australia's largest telecommunications company, shut down an installation near a kindergarten and a baby health center in suburban Sydney. The October 21 *British Medical Journal* reported that: "With their cherubic toddlers carrying placards, the group chained themselves to Telstra's fence, called in the media and became the latest players in the timeless saga of little (virtuous) people up against big (venal) companies. Within two weeks Telstra lost face and switched off the installation, maintaining its position on negligible risk but acknowledging the community's outrage. A fortnight later the same battle erupted in another suburb and is expected to spread nationally."

• Concerns from those living near cellular towers in New Zealand prompted a one-day symposium on November 18 in Christchurch to debate potential health effects. Among the speakers were Drs. Ivan Beale of Auckland University, John Goldsmith of Ben Gurion University of the Negev, Israel, Dr. Richard Luben of the University of California, Riverside and Neil Pearce of the Wellington Clinical School. According to Jennifer Macintyre of the Environmental Protection for Children Trust, one of the symposium's sponsors, the meeting was prompted by local officials' lack of sufficient knowledge and information for making critical decisions about safety and siting within residential areas.

EMFs Lead to a Fivefold Increase in Gene Expression: "Results...Do Not Support Further Studies"—Case Closed?

Reprinted below is the full text of the project summary of "Alterations in Astrocyte Functioning and Regulation of Cytokine mRNAs During Development Following Perinatal Exposure to Environmental Agents (EMF)," which appears in Status of Health Effects Research Through Fiscal Year 1995, *a report published by the National Institute of Environmental Health Sciences (NIEHS) in November (see p.17). This project on neurobehavioral dysfunction, which was led by Dr. Jean Harry of NIEHS' Laboratory of Biochemical Risk Analysis, began in September 1993 and was completed in September 1995 at a cost of $10,000.*

Under certain conditions, Harry has found that a 2 G magnetic field can cause a fivefold increase in gene expression—a type of effect that has been at the center of an intense controversy (see MWN, *J/A94, J/F95 and J/A95). In an interview with* Microwave News, *Harry said: "I am confident of the experimental validity of these results. We made considerable effort to control for any extraneous variables. The exposure was carried at the IIT Research Institute (IITRI) facility in Chicago. However, additional research is needed before any biological significance can be determined."*

"These results are intriguing," commented Dr. Imre Gyuk, program manager for DOE's EMF research.

NIEHS, however, decided to cancel the project instead of following it up. Harry said that she did not write the last two sentences of the project summary (see below). Dr. Gary Boorman, chief of NIEHS' Pathology Branch, conceded to Microwave News *that he had inserted the last paragraph "in haste." But, he added, "I am willing to reconsider." Boorman explained his decision: "The last paragraph was written with the knowledge that we did not have any more brain material available. These results will probably have to be revisited and we will need to decide how to proceed."*

Rationale and Summary

This developmental period is highly sensitive to environmental insults. This project addresses the possible effects of EMFs during the neonatal period. Studies in our laboratory have demonstrated that exposure to low levels of a known neurotoxicant, lead acetate, during the developmental period results in a shift in the developmental pattern for mRNA associated with the outgrowth of the neuronal axon and the maturation of the astrocyte. During development, the axon of the neuron elongates to form connections (synapses) with various target sites. This process is guided by the axonal growth cone at the leading edge of the axon. During development and regeneration, the developmentally regulated protein, growth associated protein-43 (GAP-43) is expressed maximally and located prominently along axons as they are elongating. This protein is enriched at the tip of the growing axon at the cytosolic surface of the growth cone membrane. Alterations in this protein during critical periods of development could result in altered axonal elongation and subsequent connectivity of the neural network.

During the formation of the brain, there is an overabundance in axonal outgrowth in order to insure contact with the proper target site. Once this contact has been made, the excess material is removed by a process of pruning. This process may be the function of immune-like phagocytic cells of the brain, the microglia. When activated, the microglia up-regulate expression of pro-inflammatory cytokines. We have identified a developmental profile for the mRNA for interleukin-1, interleukin-6 and tumor necrosis factor alpha. This profile appears to be altered by developmental lead exposure suggesting a link between the abortive axonal elongation and the decrease in the material needed to phagocytize and the induction of pro-inflammatory cytokines in the developing brain.

Given the significance of the growth of the axon, the formation of appropriate synapses on target sites and the process of "pruning" in the final formation of the neural network of the brain, we will measure mRNA for GAP-43 and pro-inflammatory cytokines early in the postnatal development of EMF-exposed animals in an attempt to detect any alterations which could suggest a subtle perturbation to the developing nervous system.

Experimental Design and Exposure Conditions

Pregnant rats were exposed to EMF for 18.5 hrs per day or intermittently (1 hr on, 1 hr off for 18.5 hrs) during their entire pregnancies and during the postnatal period using the continuous breeding protocol at IITRI. The exposure conditions were control, 20 mG, 2 G and 10 G continuous exposure, 10 G intermittent exposure. Brain tissue was collected from postnatal day 2, 3 and 5, coded, and shipped on dry ice to NIEHS. Additional brain samples were collected at the end of exposure when the offspring were adults.

RNA was isolated from the cerebellum of brains at each time point, subjected to Northern blot analysis and probed with radiolabelled cDNA for GAP-43 and Actin. The amount of radioactivity in each band representing mRNA for GAP-43 or Actin was determined.

Following Northern hybridization, the RNA samples from postnatal days 2, 3 and 5 will be analyzed for the level of mRNA for interleukin-1, interleukin-6 and tumor necrosis factor alpha by RT-PCR.

Forebrain tissue is in the process of analysis for PND 2.

Adult tissue will be evaluated for a glia specific protein—GFAP by ELISA.

Quality Assurance Measures

The identity of the exposure conditions has remained unknown throughout these experiments. For each time point, five samples per exposure condition were isolated together, run on the same gel and hybridized together to minimize variability. Exposure QA measures are associated with IITRI.

Results and Discussion

At both postnatal day 2 and 5 there was no apparent difference between exposure groups with regard to levels of GAP-43 and Actin mRNA. At postnatal day 3 the control and low-dose groups showed a low level of GAP-43 mRNA, the 10 G continuous and intermittent groups were 2 times higher, while the 2 G continuous group was dramatically higher than all other groups (5 times higher than 0 and 2 mG, 2.5 times higher than groups 10 G continuous and intermittent).

The developmental onset of GAP-43 mRNA expression occurs at a time of terminal cell division and accompanies the neuronal decision of cell fate while the continued elevation is associated with the developmental progression of the axon. This protein is enriched in the leading edge of the axon, the growth cone which provides crucial guidance in response to appropriate targets and other environmen-

tal cues. The increase in mRNA level seen at postnatal day 3 suggests that exposure to EMF produces subtle alterations in the neural network pattern of the brain. The increase could be representative of a stimulation in axonal growth as a result of a decrease in target sites or other factors involved in regulating the stability of neural connections. This observation suggests the need for further studies to examine the developmental pattern of expression of this gene as well as other associated genes that are developmentally regulated.

The results from this pilot project do not support further studies. The project will not be continued.

Clippings from All Over

[Bennett's] superficial discussion of the laboratory data and his simplistic treatment of electrical noise at the single-cell level could mislead the reader into supposing that little experimental information is available on the biological effects of ELF fields, and that nearly all the laboratory observations can be readily dismissed on the basis of physical arguments. This is far from accurate. Bennett's arguments generally proceed from a simple fact: that the ELF field levels reported to elicit these biological effects are too small to do so, being less than the body's intrinsic electrical noise over the dimensions of a single cell. But there is ample reason to expect that biological systems may exhibit responses to ELF fields that cannot readily be modeled by treating an integrated organ or tissue as a noninteracting collection of individual cells.

—Dr. Thomas Tenforde, in a review of *Health and Low-Frequency Electromagnetic Fields* (New Haven, CT: Yale University Press, 1994) by Dr. William Bennett, in *IEEE Spectrum,* p.10, October 1995

In time, monitoring your exposure to EMFs will become second nature. You will become more mindful of electromagnetic fields when you make decisions about where to live, where to send your children to school, how to arrange your furniture, which appliances to buy, where to locate them and how to use them.

—Dr. Russel Reiter, *Melatonin: Your Body's Natural Wonder Drug* (New York: Bantam Books, 1995), p.180 (see also p.2)

I happen to believe there is a danger in living under these electromagnetic fields—it's just hard to say at this point what exactly it does to you. So I'm going to wait for the science to catch up, and these kids have a better case. By nonsuiting it now, what I was really doing was protecting the rights of these children down the line.

—Joe Jamail, quoted in "Joe Jamail Passes (for Now) on Power Line Litigation," by Joseph Nocera, *Fortune,* p.48, November 13, 1995

One wag has calculated that if radioastronomy were to sell off its present allocation of protected radio frequencies to commercial interests at something like the prices for which frequencies have recently been auctioned in the United States, there would be enough cash to provide every radioastronomer with an income of $160,000 a year for the rest of time. And it would be a life of leisure; radioastronomy as a science would have to fold its tent.

—John Maddox, "Radioastronomy and the Unquiet Radio Sky," *Nature, 378,* p.11, November 2, 1995

We conclude that the association between leukemia risk and wire codes is not due to confounding by non-EMF related factors or to selection bias and may reflect a causal effect of [EMFs]. The association does not appear to be mediated simply through the mean field intensity, even after allowing for measurement error in that variable. Our findings suggest that resonances with the geomagnetic field and/or some aspect of the temporal variability in ELF field strengths may play a role. These hypotheses merit testing in future epidemiologic and experimental studies.

—Dr. John Peters et al., *Exposure to Residential Electric and Magnetic Fields and Risk of Childhood Leukemia,* Palo Alto, CA: Electric Power Research Institute, Report No.TR-104528, p.ES-3, June 1995

[The Covalt] case is a very big deal. Essentially, [environmental lawyers] are out there selling paranoia for profit. If we win, though, it closes the book on these actions in California.

—Greg Barnes, assistant general counsel of SDG&E (see also p.5), quoted in "Bucking the Current," by Michael Granberry, *Los Angeles Times,* p.B4, November 6, 1995

Epidemiologists have an abundance of valid reasons to be self-critical and cautious in the interpretation of their results, usually presented in the discussion section of manuscripts. However, epidemiologists themselves—and, to a much greater extent, nonepidemiologists—often question the validity of a particular finding because of its context rather than because of the methods that generated it. In this commentary, we argue that a concern with multiple comparisons is unwarranted. A closely related theme is the concern with the investigator's perspective—how and when the idea for collecting and analyzing data occurred, which we also argue is irrelevant to assessing the validity of the product.

—Drs. David Savitz and Andrew Olshan, "Multiple Comparisons and Related Issues in the Interpretation of Epidemiologic Data," *American Journal of Epidemiology, 142,* p.904, November 1, 1995

The [CTIA] turned to Carma [a media-evaluation consultant] in 1993 when a Florida man filed suit claiming that cellular phones caused cancer. "My first day on the job the guy went on Larry King," says the association's spokesman, Mike Houghton. For the next five weeks, Carma tracked articles written by 65 reporters. Each story was evaluated for whether it was positive or negative and assigned a score from zero to one hundred. Carma then rated reporters by the average score of their articles and ranked the journalists on a separate list in descending order of favorability so the client could quickly identify friends and foes. Carma even identified which cities had the most favorable coverage—Detroit and Tulsa were best, San Diego worst—so that a media campaign could be targeted. Pleased with the results, the industry group is still using Carma.

—Michael Moss, "Reverse Gotcha: Companies Are Paying Big Fees To Get News about Beat Reporters," *Wall Street Journal,* p.A4, November 10, 1995 (Carma's work for the DOE prompted protests.)

FCC Chairman Reed Hundt estimates that U.S. investment in new wireless systems will total $50 billion in the next five years....Collectively, the [PCS] auction winners will need but 100,000 new cell sites, far fewer than once imagined....The total bill for 100,000 installations is likely to surpass $3 billion.

—Andrew Kupfer, "The Trouble with Cellular," *Fortune,* pp.180-186, November 13, 1995

[T]he environmental movement has a political lever in the electric-car program that the utility industry so passionately supports. Public expenditure for electric transit development should be linked to the utilities' mitigation of magnetic field hazards.

—Carlos Porras of Communities for a Better Environment, quoted in "Electromagnetic Plague," by Mike Davis, *LA Weekly,* p.15, November 9, 1995

CONFERENCES

1996 Conference Calendar

January 21-25: **1996 IEEE Power Engineering Society (PES) Winter Meeting,** Baltimore, MD. Contact: Nancy Heitmann, IEEE PES Special Services, 445 Hoes Lane., PO Box 1331, Piscataway, NJ 08855, (908) 562-3881, Fax: (908) 981-1769.

February 6-7: **International Symposium on Human Health and Non-Ionizing Radiation,** Ivan Cankar Congress Center, Ljubljana, Slovenia. Contact: Peter Gajsek, Slovenian Institute of Quality and Metrology, Trzaska c.2, 61000 Ljubljana, Slovenia, (386+61) 218-006, Fax:(386+61) 218-020.

February 12-16: **4th Annual Wireless Symposium & Exhibition,** Convention Center, Santa Clara, CA. Contact: Jack Browne, *Microwaves & RF,* 611 Route 46 West, Hasbrouck Heights, NJ 07604, (201) 393-6293, Fax: (201) 393-6297.

February 29-March 3: **3rd International Congress of the European Bioelectromagnetics Association (EBEA),** Nancy, France. Contact: Gérard Prieur, EBEA, University Henri Poincaré-Nancy 1, BP 239, F-54506 Vandoeuvre Lès Nancy, France, (33) 83912071, Fax: (33) 83912391.

March 10-14: **35th Annual Meeting of the Society of Toxicology (SOT),** Convention Center, Anaheim, CA. Contact: SOT, 1767 Business Center Dr., Suite 302, Reston, VA 22090, (703) 438-3115, Fax: (703) 438-3113.

March 12: **EMFs and the Public's Health,** Rutgers University, New Brunswick, NJ. Contact: Rhonda Roby, NJ Public Health Association, 470 Piaget Ave., Clifton, NJ 07011, (201) 340-4645, Fax: (201) 340-4645.

March 18-20: **1996 International Transmission & Distribution Conference & Exhibition,** Novotel Centre, Hammersmith, London, U.K. Contact: *Transmission & Distribution,* 9800 Metcalf Ave., Overland Park, KS 66212, (913) 341-1300, Fax: (913) 967-1898.

March 24-28: **27th Annual Meeting of the Environmental Mutagen Society (EMS),** Empress Hotel, Victoria, BC, Canada. Contact: EMS, 11250 Roger Bacon Dr., Suite 8, Reston, VA 22090, (703) 437-4377, Fax: (703) 435-4390.

April 3-4: **32nd Annual Meeting of the National Council on Radiation Protection and Measurements (NCRP),** Crystal City Marriott, Arlington, VA. Contact: NCRP, 7910 Woodmont Ave., Bethesda, MD 20814, (301) 657-2652, Fax: (301) 907-8768.

April 8-12: **Symposium on Microwave Processing of Materials,** Marriott Hotel, San Francisco, CA. Contact: Magdy Iskander, University of Utah, Electrical Engineering Department, Salt Lake City, UT 84112, (801) 581-6944, Fax: (801) 581-5281.

April 9-11: **58th Annual Meeting of the American Power Conference,** Marriott Downtown Hotel, Chicago, IL. Contact: Robert Porter, Illinois Institute of Technology, Chicago, IL 60616, (312) 567-3196, Fax: (312) 567-3892.

April 9-12: **International Magnetics Conference,** Seattle, WA. Contact: Diane Suiters, Courtesy Associates, 655 15th St., NW, Suite 300, Washington, DC 20005, (202) 639-5088, Fax: (202) 347-6109.

April9-12: **7th International Congress for Hypothermic Oncology,** Rome, Italy. Contact: Cafiero Franconi, Department of Internal Medicine, Tor Vergata University of Rome, Via O. Raimondo, I-00173 Rome, Italy, (39+6) 723-5170, Fax: (39+6) 725-92821.

April 10-12: **3rd International Conference on Computation in Electromagnetics (CEM),** University of Bath, U.K. Contact: CEM Secretariat, IEE Conference Services, Savoy Place, London WC2R OBL, U.K., (44+171) 240-1871, Fax: (44+171) 497-3633.

April 14-19: **9th World Congress of the International Radiation Protection Association (IRPA),** Vienna, Austria. Contact: IRPA9 Congress Organizing Committee, Austropa Interconvention, PO Box 30, A-1043 Vienna, Austria, (43+1) 58800299, Fax: (43+1) 5867127.

April 15-18: **Annual Convention of the National Association of Broadcasters (NAB),** Convention Center, Las Vegas, NV. Contact: NAB, 1771 N St., NW, Washington, DC 20036, (202) 429-5350, Fax: (202) 429-5406.

April 26-May 3: **American Occupational Health Conference (AOHC),** Convention Center, San Antonio, TX. Contact: Nancy Olson, Director of Conferences & Meetings, AOHC, 55 West Seegers Rd., Arlington Heights, IL 60005, (708) 228-6850 ext.156, Fax: (708) 228-1856.

April 27-May 3: **4th Scientific Meeting and Exhibition of the Society of Magnetic Resonance (SMR),** New York, NY. Contact: SMR, 2118 Milvia St., Suite 201, Berkeley, CA 94704, (510) 841-1899, Fax: (510) 841-2340.

April 28-May 3: **1996 Electricity Conference & Exposition,** Montréal, PQ, Canada. Contact: Canadian Electrical Association, 1 Westmount Sq., Suite 1600, Montréal H3Z 2P9, Canada, (514) 937-6181, Fax: (514) 937-6498.

May 5-9: **1996 National Conference on Radiation Control,** Hilton Hotel, Albuquerque, NM. Contact: Conference of Radiation Control Program Directors, 205 Capital Ave., Frankfort, KY 40601, (502) 227-4543, Fax: (502) 227-7862**.**

May 13-16: **1996 IEEE National Radar Conference,** Ann Arbor, MI. Contact: Adam Kozma, University of Michigan Conferences and Seminars, 600 East Madison, Room G121, Ann Arbor, MI 48109, (313) 663-5748, Fax: (313) 764-1557.

May 18-24: **1996 American Industrial Hygiene Conference & Exposition (AIHCE),** Convention Center, Washington, DC. Contact: AIHCE, 2700 Prosperity Ave., Suite 250, Fairfax, VA 22031, Fax: (703) 207-3561.

May 20-22: **International Conference on Electromagnetic Energy,** Washington Vista Hotel, Washington, DC. Contact: Amy Nelson, Electromagnetic Energy Association, 1255 23rd St., NW, Suite 850, Washington, DC 20037, (202) 452-1070, Fax: (202) 833-3636.

May 27-31: **1996 American Electromagnetics Conference,** Convention Center, Albuquerque, NM. Contact: Chris Jones, Metatech Corp., PO Box 37378, Albuquerque, NM 87176, (505) 243-0681, Fax: (505) 243-0683.

June 1-5: **31st Annual Meeting & Exposition of the Association for the Advancement of Medical Instrumentation (AAMI),** Marriott Hotel, Philadelphia, PA. Contact: AAMI Education & Conferences Department, 3330 Washington Blvd., Suite 400, Arlington, VA 22201, (703) 525-4890, Fax: (703) 276-0793.

June 4-6: **IEEE Instrumentation & Measurement Technology Conference,** Sheraton Hotel & Towers, Brussels, Belgium. Contact: Robert Myers, 3685 Motor Ave., Suite 240, Los Angeles, CA 90034, (310) 287-1463, Fax: (310) 287-1851.

June 9-12: **Annual Conference of the Canadian Radiation Protection Association,** Trois-Rivières, PQ, Canada. Contact: Claude Dufour, Hydro-Quebec/Centrale Nucléaire Gentilly-2, 4900 Bl. Bécancour, Gentilly G0X 1G0, Canada, (819) 298-2943 ext.5138, Fax: (819) 298-5660.

June 9-13: **10th Nordic-Baltic Conference on Biomedical Engineering (NBCBME)** and **1st International Conference on Bioelectromagnetism,** Ragnar Granit Institute, Tampere, Finland. Contact: NBCBME Secretariat, Ragnar Granit Institute, Tampere University of Technology, PO Box 692, FIN-33101 Tampere, Finland, (358+31) 316-2162, Fax: (358+31) 316-2524.

June 9-14: **18th Annual Meeting of the Bioelectromagnetics Society (BEMS),** Conference Centre, Victoria, BC, Canada. Contact: Dr. William Wisecup, BEMS, 7519 Ridge Rd., Frederick, MD 21702, (301) 663-4252, Fax: (301) 371-8955.

June 13-15: **29th Annual Meeting of the Society for Epidemiological Research (SER),** Park Plaza Hotel, Boston, MA. Contact: Stacey Norin, SER, 111 Market Pl., Suite 840, Baltimore, MD 21202, (410) 223-1626, Fax: (410) 223-1620.

June 17-20: **Conference on Precision Electromagnetic Measurements (CPEM),** Braunschweig, Germany. Contact: CPEM Conference Secretary, Physikalisch-Technische, Bundesanstalt, Bundesallee 100, Braunschweig D-38116 Germany, (49+531) 592-2129, Fax: (49+531) 592-2105.

June 17-21: **1996 IEEE MTT-S International Microwave Symposium,** San Francisco, CA. Contact: MTT-S Symposium 1996, c/o LRW Associates, 1218 Balfour Dr., Arnold, MD 21012, (707) 577-3658, Fax: (707) 577-2036.

June 21: **46th Automatic RF Techniques (ARFTG) Conference,** San Francisco, CA. Contact: Mohamed Sayed, ARFTG Program Chair, 1400 Fountaingrove Pkwy., Santa Rosa, CA 95403, (707) 577-3565, Fax: (707) 577-2887.

June 25-28: **13th International Wroclaw Symposium and Exhibition on**

Electromagnetic Compatability, Wroclaw, Poland. Contact: EMC Symposium and Exhibition, Box 2141, 51-645 Wroclaw 12, Poland, (48+71) 72-8812, Fax: (48+71) 22-3473.

July 21-26: **1996 IEEE Antennas and Propagation Society International Symposium and International Union of Radio Science (URSI) Meeting,** Hyatt Regency, Baltimore, MD. Contact: Libby Croston, Johns Hopkins University, Applied Physics Laboratory, Johns Hopkins Rd., Laurel, MD 20723, (301) 953-5225, Fax: (301) 953-6123.

August 17-21: **8th Annual Conference of the International Society for Environmental Epidemiology (ISEE),** University of Alberta, Edmonton, Canada. Contact: Michelle Hoyle, 44 Lister Hall, University of Alberta, Edmonton, Alberta, T6G 2H6 Canada, (403) 492-4281, Fax: (403) 492-7032.

August 28-September 5: **25th General Assembly of the International Union of Radio Science (URSI),** Lille, France. Contact: P. Degauque, Université de Lille 1, F-59655 Villeneuve d'Ascq Cedex, France, (33+20) 33 7206, Fax: (33+20) 33 7207.

September 9-12: **26th European Microwave Conference,** Hilton Atrium, Prague, Czech Republic. Contact: Gillian Shinar, Nexus Information Technology, Nexus House, Swanley, Kent BR8 8HY U.K., (44+1322) 660 070, Fax: (44+1322) 661 257.

September 15-20: **IEEE Power Engineering Society (PES) Transmission and Distribution Conference and Exposition,** Convention Center, Los Angeles, CA. Contact: IEEE PES, see January 21 above.

September 15-20: **25th International Congress on Occupational Health (ICOH),** Stockholm, Sweden. Contact: ICOH Congress, Box 6911, S-102 39 Stockholm, Sweden, (46+8) 736-1500, Fax: (46+8) 348-441.

September 17-20: **1996 International Symposium on Electromagnetic Compatibility,** University of Rome, Italy. Contact: Mauro Feliziani, Department of Electrical Engineering, University of Rome, Via Eudossiana 18, I-00184 Rome Italy, (39+6) 445-85809, Fax: (39+6) 488-3235.

October 22: **1st IEEE Workshop on the Application of ANSI/IEEE C95.1-1992,** Wilmington, DE. Contact: Donald Zipse, Zipse Electrical Engineering Inc., 671 Kadar Dr., West Chester, PA 19382, (610) 358-1462, Fax: (610) 793-1693.

October 31-November 3: **18th Annual International Conference IEEE Engineering in Medicine and Biology Society,** Amsterdam, The Netherlands. Contact: Michael Neuman, Program Co-chair, MetroHealth Medical Center, 2500 MetroHealth Dr., Cleveland, OH 44109, Fax: (216) 459-4608.

November 3-7: **International Conference on Radiation and Health (ICRH),** Beer Sheva, Israel. Contact: ICRH, Ortra Ltd., 2 Kaufman St., Textile Center, PO Box 50432, Tel Aviv 61500, Israel, (972+3) 517-7888, Fax: (972+3) 517-4433.

November 12-14: **International Symposium on Antennas,** Université de Nice, France. Contact: Conference Secrétariat, CNET-PAB, F-06320 La Turbie, France, Fax: (33+93) 41 0229.

November 17-21: **DOE-EPRI Annual Review of Research on Biological Effects of Electric and Magnetic Fields from the Generation, Delivery and Use of Electricity,** St. Anthony's Hotel, San Antonio, TX. Contact: W/L Associates Ltd., 7519 Ridge Rd., Frederick, MD 21702, (301) 663-1915, Fax: (301) 371-8955.

Higher Leukemia Rates Among Those Living Near Australian TV Towers *(continued from p.1)*

In 1987, a similar study identified higher rates of cancer among those living near radio and TV broadcast towers in Honolulu. However, this finding was never followed up. Dr. Bruce Anderson and Alden Henderson of the Hawaii Department of Health found higher rates of cancer—and leukemia—in census tracts with broadcast towers (see *MWN,* M/J87). An RF/MW survey by the Environmental Protection Agency had shown that the city of Honolulu had the highest radiation levels of any U.S. urban area (*MWN,* J/F85). Dr. William Morton of the University of Oregon's Health Sciences Center in Portland had found parallel trends in his study of cancer and broadcast radiation in Portland (see *MWN,* J/F82 and My82).

In a paper to be published next year, Dr. Stanislaw Szmigielski of the Center for Radiobiology and Radiation Safety in Warsaw, Poland, will present data showing that young military personnel exposed to RF/MW radiation had more than eight times the expected rate of leukemia and lymphoma (see *MWN,* M/J95).

According to calculations by Hocking's team, the RF/MW power density in the areas closest to the towers in North Sydney was 8 $\propto$W/cm^2 and decreased to 0.2 $\propto$W/cm^2 at a distance of two-and-a-half miles. In contrast, the RF/MW levels in the control communities—seven-and-a-half miles from the towers—were approximately 0.02 $\propto$W/cm^2.

The 1992 ANSI/IEEE standard allows exposures of approximately 200-600 $\propto$W/cm^2 at radio and TV broadcast frequencies for the general public. In Australia, the exposure standard is 200 $\propto$W/cm^2 for the 30 MHz-300 GHz band.

Hocking's new findings come at a time when there is an initiative to relax Australia's RF/MW exposure standard. They also coincide with ongoing battles over the siting of cellular phone antennas. A neighborhood group in suburban Sydney recently blocked the installation of a cellular tower by Telstra near a kindergarten, due in part to concerns over long-term exposure to RF/MW radiation (see p.12).

In an interview with *Microwave News,* Hocking commented that, "It would be stretching too far to apply our broadcast results to cell phone towers." But, he added, "It would be prudent for some countries to set up prospective epidemiological cancer studies of the possible effects of mobile phones—both base stations and hand-held units—so that in ten years we have some answers."

"The first step," Hocking continued, "is to confirm these Australian findings and then take another look at Honolulu. After that, we should investigate other communities near broadcast towers, such as Crystal Palace in London."

Hocking presented his new results in a poster paper at the Department of Energy's annual review of EMF research, which was held in Palm Springs, CA, November 13-16.

The three towers transmit the signals of four TV stations with peak powers of 100 kW for the video signals and 10 kW for the audio signals. There is also a 50 kW FM station, according to Hocking.

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CANCER RATES

Childhood Leukemia... One of the favored arguments among those who dismiss the EMF–cancer connection is that cancer rates have not kept up with the increased use of electricity during the 20th century (see *MWN,* M/J92, J/A92 and N/D92). Most epidemiologists—one exception is Harvard's Dr. Dimitrios Trichopoulos—reject this view as insupportable (see *MWN,* J/A92 and J/F93). But even if the two variables are indeed causally related, there is another issue: A number of studies show that certain types of cancer *are* increasing (see *MWN,* J/F91 and J/A91). As Dr. Philip Landrigan, the chairman of the Department of Community Medicine at Mt. Sinai School of Medicine in New York City, reminded the readers of the *New England Journal of Medicine* (November 9): "...the incidence rate of new cases [of childhood leukemia] has increased steadily in the United States over the last two decades." Landrigan went on: "For acute lymphoblastic leukemia (ALL), the most common form of leukemia among children, the cumulative increase in the incidence rate from 1973 to 1991 was 20.0%. The increase is particularly striking among white children. The causes are not known."

EMF RAPID RESEARCH

Recent Developments... The NIEHS has awarded two new three-year biomedical grants under the EMF RAPID program (see *MWN,* S/O94 and M/A95). Dr. Roy Aaron of the Orthopaedic Research Lab at the Rhode Island Hospital in Providence received $599,000 for research on EMFs and early bone development, and Dr. Andrew Marino of the Louisiana State University Medical Center in Shreveport received $562,000 for work on the effects of 60 Hz magnetic fields on lymphoid phenotype. Descriptions of these and other RAPID grants, as well as other EMF research funded by NIEHS, are available in an NIEHS report issued in November, *Status of Health Effects Research Through Fiscal Year 1995: Project Summaries, Experimental Designs and Results*. It is available from: Naomi Bernheim, NIEHS, PO Box 12233, Research Triangle Park, NC 27709, Fax: (919) 541-4714....The NAS-NRC committee charged with reviewing RAPID research has completed its 1995 interim report, as required under the Energy Policy Act (see *MWN,* M/A95). "A great deal of care has gone into the development of the research strategy for the EMF RAPID program, and no glaring omissions in the program can be identified," the committee concluded. Chaired by Dr. Charles Bean of Rensselaer Polytechnic Institute in Troy, NY, the committee stressed that, "When attempting to replicate previous experiments, one must follow the original protocol with obsessive precision because, there being no accepted theory of why one should see any effect at all, one has no idea as to which steps are truly essential and which can be modified or bypassed."... Dan Vandermeer, NIEHS' RAPID program director, retired from NIEHS effective December 3 but will continue to work on RAPID under contract to the agency. "I have been asked by [NIEHS Director Ken] Olden to continue to manage several short-term, high-visibility projects," Vandermeer told *Microwave News,* noting that he will keep his seat on the interagency

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committee and continue as its cochair. Vandermeer announced his plans at the November 16 meeting of the National EMF Advisory Committee (NEMFAC) in Palm Springs, CA....Joe Garcia, a commissioner of the Florida PSC in Tallahassee, made his first appearance as a member of NEMFAC at that meeting. He replaces John Coughlin, who resigned from the committee when he stepped down from the Wisconsin PSC (see *MWN,* M/A95)....And in a related development, Dr. Stephanie London has left the University of Southern California in Los Angeles to join NIEHS' intramural research program in Research Triangle Park. She said that she plans to continue her breast cancer study (see *MWN,* N/D94) and expand her work in the areas of breast cancer, melatonin and EMFs.

LEGAL NOTES

Shift-Work Compensation... On October 26, a Pennsylvania court ruled that shift-work maladaptation is a compensable injury under the state's workers' compensation system, according to an item in the November 20 *National Law Journal*. The worker claimed to have suffered from diarrhea, cramps, headaches and vomiting due to a disruption of his circadian rhythm.

MEDICAL APPLICATIONS

Prostate Shrinker... An FDA advisory committee has unanimously recommended approval for the Prostatron, a device that uses microwave energy to reduce an enlarged prostate gland. The unit operates at 1296 MHz and kills excess tissue, heating it to temperatures reaching 111°F. The Prostatron, made by the French company EDAP International and marketed in the U.S. by the Technomed Group of Cambridge, MA, is already in use in 25 countries. Treatment with the Prostatron costs about half as much as surgery, does not appear to have such side effects as impotence or incontinence, takes an hour to complete and does not require anesthetics. It is also considered to be more effective than drugs in reducing swollen tissue. The FDA panel asked EDAP to monitor the health of at least 100 patients over a five-year period following treatment with the Prostatron in order to ensure that there are no long-term complications. Repeated calls to Technomed requesting specific absorption rates (SARs) for the prostate gland and nearby tissue from the device were not returned. FDA approval of the device is expected. (See also *MWN,* J/A89.)

RESEARCH FELLOWSHIPS

Postdoctoral Openings...NIOSH's Division of Biomedical and Behavioral Sciences is seeking qualified researchers for *in vitro* and *in vivo* studies on EMF bioeffects. NIOSH explained that it is "unusual to find an individual with talents required for complete studies, i.e., having both physical (EMF) skills and biochemical/cellular physiology expertise." The research will be carried out as part of NIOSH's participation in DOE's and NIEHS' EMF RAPID program and will be administered by the NAS-NRC. The application deadline is January 15, 1996. For more information, contact: Dr. Russell Savage, MS-C22, NIOSH, 4676 Columbia Pkwy., Cincinnati, OH 45226, (513) 533-8289, E-mail: ras6@niobbs.em.cdc.gov.

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MICRO WAVE NEWS

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NAS Finds No EMF–Cancer Link; Report Stirs Controversy

Wertheimer and Leeper Are Vindicated

There is "no conclusive and consistent evidence" that residential exposures to electromagnetic fields (EMFs) present a human health hazard, according to a long-awaited report from the National Academy of Sciences-National Research Council (NAS-NRC). At the same time, the NAS-NRC found that children living near high-current power lines do have a higher-than-expected incidence of leukemia.

"The findings to date do not support claims that EMFs are harmful to a person's health," said Dr. Charles Stevens of the Salk Institute in La Jolla, CA, the chair of the NAS-NRC committee that wrote the report. Stevens also said, "We have no idea why wire codes are linked to a small increase in leukemia risk."

More Coverage of the NAS-NRC Report on pp.5-8
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Wire codes categorize homes according to their proximity to different types of power lines, a system first devised by Dr. Nancy Wertheimer and Ed Leeper. In 1979, Wertheimer and Leeper reported that children living in high-current wire code homes had an elevated risk of developing cancer.

Dr. Daniel Wartenberg and his fellow NAS-NRC committee members did a meta-analysis of 11 epidemiological studies of power lines and childhood

(continued on p.5)

Views on the News: The NAS-NRC Report

Cancer Near Power Lines: The Search for "Factor X" Continues

The NAS-NRC panel decided that children living near power lines do indeed have elevated rates of leukemia, but that EMFs are not to blame. What then is responsible? The committee members said they don't know.

In the 17 years since Dr. Nancy Wertheimer and Ed Leeper first announced that power lines and, most probably, EMFs are associated with childhood cancer, electric utilities and their consultants have argued that Wertheimer and Leeper were wrong. They have looked far and wide for an elusive "factor X" that would exonerate EMFs—but without success.

Critics have used three arguments against Wertheimer and Leeper. First, they contended that the epidemiology was faulty. In 1985, while Dr. David Savitz was still working on his replication study, an Electric Power Research Institute (EPRI) report charged that, "All the statistical analyses in the Wertheimer and Leeper paper were performed incorrectly" (see

(continued on p.7)

« Power Line Talk »

Eight of the **U.K.**'s major electricity companies, including the **National Grid Co.**, are considering setting up an £8 million fund to fight EMF litigation, Simon Holberton of the ***Financial Times*** reported on October 11. "A priority of the electricity industry must be to prevent [a] legal precedent being established," stated a confidential memo by **Willis Corroon**, a leading U.K. insurance brokerage. "This will require the strenuous defense of any claims, and the associated defense costs are likely to be high." Several pending lawsuits and increased public awareness have made EMFs a high-profile issue in the U.K. (see *MWN,* M/J95). "The uncertainty surrounding this topic has created unease in the insurance market and has resulted in coverage being restricted," according to the memo, which also noted that, "Some insurers will not participate in the liability program of an electricity utility if it includes protection against liability for EMFs." A 1994 Corroon survey had revealed that British electricity companies saw the potential liability arising out of EMFs as one of two prime areas of concern. (The other was storm damage to transmission and distribution networks.) In the memo—which was mailed to Holberton with an anonymous note that read, "You might find this of interest"—Corroon downplayed the threat of EMFs, contending that a causal relationship between EMFs and negative health effects has not been proven. "Willis Corroon has put forward a proposal and no decision has yet been made," cautioned Derek Lickorish in the October 21 issue of *Business Insurance*. Lickorish is the director of customer service and external affairs at **South Western Electricity**, one of the eight utilities involved. Attorney **Martyn Day** of Leigh, Day & Co. in London—who is representing four families of childhood leukemia victims—said he was "shocked" by the memo: "This is stacking the deck against the plaintiffs."

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On November 22, the Georgia Supreme Court refused a utility request to block a new trial in the ***Jordan*** EMF–cancer lawsuit. In May 1994 a jury returned a pro-utility verdict, but a state appeals court ordered a retrial in November 1995 (see *MWN,* M/J 94, J/F96 and M/J96). "We're delighted to have the opportunity to try the case again," said Nancy Jordan's attorney, **Bruce DeBoskey** of Silver & DeBoskey in Denver."Last time the jury was split 50-50 on causation." **Georgia Power Co.** did not respond to a request for comment.

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The same adversarial reporting style for which **John Stossel** of **ABC News** is renowned could have landed him in prison. As part of his upcoming television special on "junk science"—which was to include a segment on EMFs (see *MWN,* J/A96)—Stossel sent two women posing as multiple chemical sensitivity (MCS) victims to visit Dr. **Grace Ziem**, a Baltimore-based specialist in the field. In an interview, Ziem said she thought the women appeared to be too healthy to be chemically sensitive. Her suspicions were confirmed when a colleague told her that Stossel was setting her up. Upon reading the transcript of Stossel's 1994 special "Are We Scaring Ourselves to Death?" which questioned the need for many federal health and safety regulations, Ziem believed that she would be portrayed as a "junk scientist." Rather than go ahead with an interview with Stossel, she sent an assistant, accompanied by two newspaper reporters, to read Stossel a statement. The assistant claimed that afterwards, Stossel and one of the phony patients, **Deborah Stone**, an ABC producer, admitted that the initial medical exams had been recorded without Ziem's consent, which in Maryland is a violation of wiretap laws and a felony. Ziem filed a complaint against Stossel, Stone, ABC and others. Like Stossel, Stone is no stranger to controversy: In 1986 she and nine members of the *Dartmouth Review,* of which she was the managing editor, were suspended from Dartmouth College in Hanover, NH, for destroying shanties set up to protest the school's business interests in South Africa. Ziem said that she knew of MCS cases at ABC, and any attempt by the network to discredit their legitimacy would be a conflict of interest. "Stossel and ABC have harmed many Americans by misinforming them in the area of public health," Ziem told *Microwave News*. A court hearing was scheduled for December 10, but, as we went to press, ABC announced that the prosecutor would not proceed with the case. ABC's Todd Seavey noted that the EMF segment was likely to be cut from the special, which is now scheduled for January. He said that the EMF item would probably appear separately on one of ABC's news magazines, *20/20* or *Prime Time Live*. The MCS segment will run on January 3 on *20/20*.

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When the California Supreme Court dismissed the ***Covalt*** EMF property devaluation case last August, the Covalts' attorney, **Michael Withey** of Schroeter, Goldmark & Bender in Seattle, called the decision "a frontal attack on the right to private property" and stated that he might take the case to the U.S. Supreme Court (see *MWN,* S/O96). But in December, Withey told *Microwave News* that there would be no appeal (see also p.15).

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Despite protests from the community, **Empire District Electric Co.** intends to go ahead with its plans to build a 161 kV power line in **Joplin, MO**, that would run across the street from an elementary school. **Citizens Concerned for Our Children's Health** includes a number of medical doctors, including Dr. **Jeffrey Greenberg**, a neurologist who told *Microwave News,* "With the information available from the numerous independent scientific investigations from all over the world, the data continue to point towards a strong link of leukemias and brain cancer in relation to exposure to EMFs." The **NAS-NRC report** (see p.1) has apparently done little to appease the community: 75% of respondents to a poll published on November 12 by the *Joplin Globe* still oppose the line. (This figure is not statistically reliable, however, since the voters were self-selected rather than picked at random.) In its own newsletter, Empire District Electric countered the protesters: "[T]hey are trying to scare their neighbors with emotional sound bites from selected research." For his part, Greenberg criticized Empire's use of a statement from the **American Physical Society** to dismiss EMF health effects, saying, "It

was like having a group of physicians disqualifying current new concepts in astrophysics." An editorial in the *Globe* on October 10 cautioned readers about the doctors' involvement: "If this indicates a long-term, organized effort by the medical community to offer its voice on health and environmental issues, welcome. But failure to maintain involvement could be interpreted by some as self-serving, since several doctors and their families are among those being affected by the proposed line." Greenberg's wife, Susan, a spokesperson for the citizens' group, said that she and her husband helped organize the protest in the interest of the community's concerns, pointing out that their children do not attend the elementary school and that the proposed line would not pass near their home. Empire will begin construction on the line when condemnation hearings are completed, according to Amy Bass, director of corporate communications for Empire, which is based in Joplin.

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John Altoonian and his wife have agreed to an out-of-court settlement of their EMF–cancer lawsuit against **Atlantic Electric**. Neither side would comment on the terms of the agreement or the date it was reached, but notice of the settlement was filed on September 4 in New Jersey Superior Court in Cape May County. The agreement was reached following a jury verdict that would have required the utility to pay the Altoonians $946,267, and after appeals had been filed by both sides (see *MWN,* M/J96 and J/A 96). In a statement issued through the utility's local attorney, **Randolph Lafferty** of Youngblood, Corcoran in Pleasantville, NJ, Atlantic Electric explained that there had been "a confidential settlement of the non-EMF-related issues." The utility asserted that its decision to settle had been "primarily motivated by economic considerations and humanitarian concerns for the plaintiff." The statement emphasized the company's view that, "The jury verdict in this case, which established that there is no causal connection between EMFs and the plaintiff's leukemia, stands as a vindication of the company and the industry." Altoonian's lawyer, **William Wolf** of Bathgate, Wegener & Wolf in Lakewood, NJ, told *Microwave News* that he would have no comment on the settlement. Altoonian was diagnosed with chronic myelogenous leukemia in 1990 and filed suit in 1991. On April 19, 1996, a jury found the Egg Harbor, NJ-based utility not guilty of causing Altoonian's disease, but concluded that an Atlantic Electric power line illegally buried on the Altoonians' property had caused the couple to suffer emotional distress. The settlement is believed to be the first cash payment from a utility to put an end to an active EMF lawsuit. In mid-1995, **Massachusetts Electric** was reported to have paid an undisclosed amount to **Scot David** and his wife, whose child had contracted leukemia (see *MWN,* J/A95). But that settlement was a preemptive one, coming before the David family had actually filed court papers.

Prudent Avoidance, Utility-Style

The concept of "prudent avoidance" of EMF exposures has recently been the target of repeated attacks. For example, Dr. Patricia Buffler has written that this policy is "in conflict with the scientific evidence, since we don't know that there is anything here to avoid." She has been joined in this criticism by a number of physicists, including Drs. David Hafemeister, Robert Park and Richard Wilson (see *MWN,* J/F95, M/J95, J/A95, S/O95 and N/D95).

Dr. Jack Sahl of Southern California Edison Co. in Rosemead, CA, has many views in common with these critics as to whether EMFs are harmful to human health. As he told *Microwave News,* he rejects the notion that there is "some significant chance" that EMFs will turn out to pose a public health threat. But in the September 1996 issue of *Environmental Health Perspectives,* he argued that attacking prudent avoidance is shortsighted. Instead, he wants to shape how it is defined.

Sahl's article, which he coauthored with Dr. Michael Dolan of the Electricity Supply Association of Australia Ltd. in Melbourne, contained almost no discussion of what possible health risks a policy of prudent avoidance might prevent. It emphasized how accepting some type of prudent avoidance policy can help shape public opinion.

Whether or not EMFs pose any health risk, Sahl said, "There's a larger societal benefit from having embraced this kind of decision-making and getting a certain level of acceptance and support." He explained that this "should help the whole society have more support for science-based policy in the future."

Sahl and Dolan summed it up this way:

> Our fundamental goals are to increase cultural and societal trust in our scientific and regulatory authorities...and avoid ineffective risk regulation and inappropriate litigation.

Key to their argument is the idea that prudent avoidance and "science-based policy" are two very different categories. They cited the International Committee on Non-Ionizing Radiation Protection (ICNIRP) limit of 1,000 mG for public EMF exposures as an example of the latter.

The benefit of prudent avoidance, to Sahl and Dolan, is that it is "seen to be addressing people's concerns rather than simply waiting for more formal science-based regulation." If authorities show that they are sensitive to those concerns, then it will be easier to get the public to accept the work of "quasi-governmental scientific panels" in the future.

The article noted that there is scientific uncertainty about whether EMFs pose a health risk. But Sahl does not believe there is much evidence that they are harmful. Accordingly, his version of "prudent avoidance" is narrower than some others. Sahl and Dolan argued that prudent avoidance can never be used to justify a numerical exposure limit—such as the interim guidelines proposed by the National Council on Radiation Protection and Measurements (NCRP) committee on EMFs in mid-1995 (see *MWN,* J/A95). They compared "nonscience-based numeric standards" to "wolves dressed as sheep."

They also insisted that "ALARA (as low as reasonably achievable)-type responses" are "inappropriate to the EMF issues because they do not provide guidance as to what is reasonable."

Finally, they favored a strict interpretation of the "no- or low-cost" nature of prudent avoidance measures, since "it would be a mistake to divert scarce resources from something with known benefits to the uncertain benefits of reducing exposures to EMFs." Asked what he thought of the California Public Utilities Commission's definition of "low-cost" as less than 4% of the total cost of a power line project, Sahl replied, "That's been working fine" (see *MWN,* N/D93).

If prudent avoidance is "carefully used," Sahl and Dolan concluded, it can be adopted by utilities and regulators "without compromising [their] legal or public policy positions." In other words, prudent avoidance is something they can live with—as long as it's defined in the right way.

No Magnetic Field Risks for Adult Cancers, Says New Finnish Study

Adults living near high-voltage power lines do not have an increased risk of cancer, according to a large new epidemiological study. Researchers at the University of Helsinki reached this conclusion after examining the cancer history and magnetic field exposure of every such adult in Finland.

"The results of the present study suggest strongly that typical residential magnetic fields generated by high-voltage power lines are not related to cancer in adults," Dr. Pia Verkasalo and coworkers reported in the October 26 issue of the *British Medical Journal (BMJ, 313,* pp.11-15, 1996).

Verkasalo and her coauthors found "no major increases" in risk among the cohort for 21 varieties of cancer. "The previously suggested associations between magnetic fields and tumors of the nervous system, lymphoma, leukemia, and breast cancer in women were not confirmed," they wrote.

The Finnish team pointed out that this was the first nationwide study of its kind, involving 5 to 25 times more people than past residential cohort studies. It included 8,415 cancer cases from a cohort of 383,700 adults living within 500 meters of all 110-400 kV high-voltage lines in Finland.

Verkasalo did not take any magnetic field measurements; instead, she based exposures on historical power company records. A detailed account of the exposure assessment was published in *Bioelectromagnetics* last year *(16,* pp.365-376, 1995).

NIEHS Plans Risk Assessment

The National Institute of Environmental Health Sciences (NIEHS) has announced its strategy for the EMF risk assessment required by Congress under the RAPID program.

In the first phase of the process, scientific studies will be evaluated in a series of symposia, explained Dr. Christopher Portier, who is leading the effort. Planning is under way for the first symposium, to be held March 24-27, which will focus on *in vitro* research. Two more are planned—on epidemiological and *in vivo* studies—after which a working group will analyze all the data. (The symposia will be open to the public.) The director of the NIEHS will then prepare a report for Congress.

As to whether there is a need for another review in the wake of the NAS-NRC report, Dr. Gary Boorman, NIEHS' RAPID program manager, told *Microwave New*s that, "There's been a lot of data published since the cutoff date for the NAS report, which we will have to look at."

To receive future updates, write to Portier at: NIEHS, PO Box12233, MD A3-06, Research Triangle Park, NC 27709. For more on the strategy, visit the EMF RAPID Web site: <www.niehs.nih.gov/emfrapid/home.htm>.

Meanwhile, the results of the first five of eight engineering studies funded by the RAPID program will be presented on February 3 at the *IEEE PES Winter Power Meeting* (see p.17), according to Bill Feero of Electric Research & Management Inc. in State College, PA.

Adult Residential Studies Reviewed

A new review of the seven published studies on cancer rates among adults living near power lines concluded that the research to date is insufficient to establish a link.

"[I]t seems that the evidence is not strong enough to support the putative causal relation between residential exposure to magnetic fields and adult leukemia, brain tumors or breast cancer," Drs. Chung-Yi Li and Gilles Thériault of McGill University and Dr. Ruey Lin of the National Taiwan University in Taipei wrote in *Occupational and Environmental Medicine (53,* pp.505-510, 1996).

They suggested that future studies should focus on female breast cancer and should include occupational exposures.

Dr. Richard Stevens of the Battelle Pacific Northwest Labs in Richland, WA, who carried out his own adult residential study, (see *MWN,* N/D86 and M/J88) expressed concern over possible misclassification of cumulative EMF exposure. "No account is taken of distribution lines or appliance use...which can play a large role in determining cumulative exposure," he said.

Although the *BMJ* paper did not detail exposures at work, Verkasalo has now discounted their possible influence. "We looked at possible confounding from occupational exposures and found they did not change our results," she told *Microwave News.* The occupational assessment as well as an analysis of leukemia subtypes appears in the December 1996 issue of the *Scandinavian Journal of Work, Environment and Health.*

At the Department of Energy's EMF review in November in San Antonio, Verkasalo reported that there was a statistically significant risk ratio of 4.8 for chronic lymphatic leukemia among those adults exposed 12 or more years before diagnosis. "It's not clear what this means," she said.

A similar study by Drs. Maria Feychting and Anders Ahlbom of the Karolinska Institute in Stockholm, Sweden, found that adults with the highest cumulative exposures to power line EMFs had twice the risk of developing acute or chronic myeloid leukemia than did less-exposed adults (see *MWN,* S/O92 and S/O94). Comparing the new findings to the Swedish study, Dr. Gilles Thériault of McGill University in Montreal, Canada, noted that, "Verkasalo has only four cases of leukemia among people exposed at 2 ∝T-yr (20 mG-yr) and above, whereas Feychting-Ahlbom had 29 cases in this same category." He pointed out that Verkasalo's confidence interval includes Feychting-Ahlbom's risk ratio and therefore the results are "compatible."

In an interview on the Finnish study, Feychting commented, "It's hard to make any firm conclusions given the small number of cases."

Verkasalo did observe increases in melanoma, female colon cancer and male multiple myeloma. The 8% increased risk found in melanoma—which would translate into one extra case per year in Finland—was viewed as "rather low." She also stated that the increase in female colon cancer, although statistically significant, "may well be due to chance." While men showed a 22% higher risk for multiple myeloma, the risk for women was 2% lower than expected. Verkasalo concluded that, "[T]he role of extremely low frequency magnetic fields in the pathogenesis of myeloma, melanoma and colon cancer remains uncertain."

cancer, and they agreed with Wertheimer and Leeper's finding. The panel calculated that the studies indicated a 50% higher rate of childhood leukemia, a statistically significant increase. The committee called the association "robust," explaining that, "Eliminating any single study from the group does not alter the conclusion that the association exists."

The panelists did not attribute the excess leukemia to EMFs because of two "contradictions." First, present-day measurements of magnetic fields do not show an association with leukemia. Second, there is no consistent dose–response relationship.

"The lack of an association with measured fields is not as important as some people have said," Leeper, of Boulder, CO, told *Microwave News*. "Careful use of wire codes may simply be the better way to evaluate historical field levels, rather than an indicator of some hidden factor."

In response to a question from the audience at the November EMF research review in San Antonio, Dr. William Kaune stressed that, "The argument that contemporaneously measured magnetic fields are not associated with a cancer that occurred 20-25 years in the past is not a valid argument." Kaune, of EM Factors in Richland, WA, is leading the EMF measurements for the ongoing childhood cancer study at the National Cancer Institute (NCI).

Committee members noted that there were no explanations better than EMFs: "Past efforts to identify [other risk factors] have failed, and few strong candidates can be postulated at present," they wrote in their report.

In addition to rejecting a link between EMFs and cancer, the NAS-NRC committee also rejected the idea that residential exposures to EMFs lead to adverse neurobehavioral effects or reproductive and developmental effects.

The committee also concluded that:

- There is "no convincing evidence" that exposure to 60 Hz EMFs causes cancer in animals.
- Above 500 mG, there are "credible positive results" for *in vitro* effects, including gene expression, but not at 0.1-10 mG.
- There is "convincing evidence" that 5 G pulsed magnetic fields can induce bone repair in animals.

Some observers have complained that by seeking "conclusive" proof of an EMF health risk, the NAS-NRC panel set an impossible standard. "They set the bar too high," said Dr. Paul Gailey of the Oak Ridge National Lab in Oak Ridge, TN. "We all agree that there is no *conclusive* evidence linking EMFs and cancer," said Dr. Imre Gyuk, who managed the report for the Department of Energy (DOE). "We didn't need the academy to tell us that." The report cost the DOE $622,000 (see *MWN,* S/O91 and S/O96).

"Only by setting the threshold that high could we come to a consensus," Dr. David Savitz, the committee vice chair, explained to *Microwave News*.

Neither Stevens nor Savitz would estimate the likelihood that EMFs may be responsible for the increased leukemia risk among children. "I can't commit to a number," Savitz said. "Based on the epidemiology alone, EMFs are the most likely risk factor, though the case is far from compelling."

Many of the 16 committee members agree with Stevens's view that EMFs pose no cancer risks. Dr. Paul Slovic, for one, went further and questioned whether the data can support the link to power lines. "The epidemiological studies are hard to get a handle on," he said in an interview. "They are very crude."

Other panelists with extensive EMF experience think that EMFs are probably the cause. "I would estimate that the possibility that EMFs are responsible is greater than 50%, but not above 75%," said Dr. Larry Anderson.

Wartenberg offered a similar assessment: "While the data do not show a causal link between EMFs and childhood leukemia, I believe that magnetic fields are still the most likely candidate."

At the San Antonio meeting, committee member Dr. Daniel Driscoll told the audience that, in fact, the NAS-NRC report says that EMFs are "the best candidate" for the risk factor to explain the excess childhood leukemia.

Both Driscoll and Savitz expressed regret for the way the conclusions had been phrased. "It seemed like a natural thing to do to use a high level of proof," Driscoll said. "But when I saw the headline in *Science,* PANEL FINDS EMFS POSE NO THREAT—which is a total misinterpretation of what the report says—I thought perhaps we should have been more alert as to how the conclusions were written." Savitz commented that, "I did not think through the implications of offering such a flatly negative verdict."

Dr. Indira Nair of Carnegie-Mellon University in Pittsburgh argued against the use of absolutes by the committee members. "By leaving out the uncertainty, they gave a false impression of certainty about an absence of health effects," she said.

Ongoing studies may dispel some of that uncertainty. "I think

NAS-NRC EMF Panel Members

Dr. Charles Stevens, Salk Institute, La Jolla, CA (chair), Dr. David Savitz, University of North Carolina, Chapel Hill (vice chair). The other members are: Drs. Larry Anderson, Battelle Pacific Northwest Labs, Richland, WA; Daniel Driscoll, New York Department of Public Service, Albany; Fred Gage, Salk Institute, La Jolla, CA; Richard Garwin, IBM Watson Research Center, Yorktown Heights, NY; Lynn Jelinski, Cornell University, Ithaca, NY; Bruce Kelman, Golder Associates, Redmond, WA; Richard Luben, University of California, Riverside; Russel Reiter, University of Texas, San Antonio; Paul Slovic, Decision Research, Eugene, OR; Jan Stolwijk, Yale University School of Medicine, New Haven, CT; Maria Stuchly, University of Victoria, BC, Canada; Daniel Wartenberg, University of Medicine and Dentistry of New Jersey, Piscataway; John Waugh, Massachusetts Institute of Technology, Cambridge; and Jerry Williams, Johns Hopkins University, Baltimore, MD.

How To Order NAS-NRC Report

The NAS-NRC report, *Possible Health Effects of Exposure to Residential Electric and Magnetic Fields,* is only available in prepublication (typescript) form at present.

The National Academy Press (NAP) will publish the report in late January or early February 1997, according to Dan Quinn of the NAS press office.

For now, a copy costs $45.00, plus any applicable taxes; write: NAP, 2101 Constitution Ave., NW, Lockbox 285, Washington, DC 20055. With a credit card, call (800) 624-6242 or (202) 334-3313. You can also order the report over the Internet at: <www.nap.edu>.

The Future of EMF Research

There was a pall over the November DOE EMF research review in San Antonio. Many were worried that the NAS-NRC report would lead to major cuts in EMF funding.

Two questions came up over and over again: Would the congressionally mandated RAPID program escape the budget knife? And would the separate DOE biological mechanisms program survive?

These concerns had already prompted three members of the NAS-NRC committee to issue a minority statement at the same time as the release of the official report. Drs. Larry Anderson, Richard Luben and Maria Stuchly stressed that, "There are still important questions that need to be addressed."

"Research is the only way to find the answers to unexplained observations such as an apparent link between EMF exposure and some forms of cancer," they argued. Luben is the president of the Bioelectromagnetics Society (BEMS); Anderson and Stuchly are both past presidents of BEMS.

As a whole, the NAS-NRC committee was more ambivalent, though it did agree that, "Continued research is important" because "the possibility that some characteristic of the electric or magnetic field is biologically active at environmental strengths cannot be totally discounted."

Even some of the committee members who are skeptical about EMF health effects are not totally against more research, albeit at a low level of funding. "I do believe that there should be a modest amount of high-quality research on physiological effects of EMFs," Dr. Richard Garwin, a physicist, told *Microwave News,* explaining that, "Since there is no evidence that EMFs at residential levels do anything bad to anyone, there is no great urgency."

Dr. Charles Stevens, the committee chair, commented that the whole issue will never be settled until the association between increased childhood leukemia rates and high-current power lines can be explained. The panel members called this need "most compelling." However, like Garwin, they argued that, because there is no "threat to public health," no "adjustment in national research policy" is warranted.

One committee member argued passionately against any more epidemiological studies, however. "They increase public concern at a faster rate than they reduce scientific uncertainty," said Dr. Paul Slovic in an interview. Slovic favors *in vitro* research instead.

Most utility representatives want EMF studies to continue. "There is more research to be completed," said Dr. Kelly Gibney of BC Hydro in Burnaby, Canada, at the DOE meeting. Bill Croker of Georgia Power in Atlanta agreed, but cautioned that his managers and those at other companies see the EMF issue as being in decline. "It is easy for the utility industry to de-emphasize the EMF issue in our new, competitive environment," he said.

Dr. Leeka Kheifets, the manager of EMF research at the Electric Power Research Institute (EPRI) in Palo Alto, CA, said that she hopes that her program will continue at about the same level of funding. She noted that, "EPRI's emphasis is very much in line with the academy's recommendations for future research."

Half of the money for the RAPID program is supposed to come from industry, but this pledge has never been fulfilled. Indeed, with a shortfall of government appropriations and industry funding, what was billed as a $65 million research program may pay for only $35 million worth of biological studies.

Over the last two years, corporate donations have fallen more than $1.5 million behind even the reduced levels of government funding. And some see more trouble ahead: "I am hearing that the DOE may have difficulty raising the utility contributions for the RAPID program," said Lynne Gillette, DOE program manager for RAPID.

Richard Loughery, the EMF issue manager at the Edison Electric Institute (EEI) in Washington, predicted that the EEI's members would come through. "We are very committed to seeing that the RAPID program is successfully completed, as originally intended by Congress." But he did interject a note of caution: "Because of the publicity on the NAS-NRC report, it may take a greater effort to get utility contributions."

Speaking for the National Electrical Manufacturers Association (NEMA) in Washington, Douglas Bannerman reaffirmed his trade group's support for EMF RAPID. But he was lukewarm about the DOE's own biological mechanisms program. "NEMA has no feeling one way or another," he told *Microwave News*.

Loughery was less certain about funding after the RAPID effort is completed. "I would like to see what recommendations come out of the RAPID program. It is a very important milestone," he said. Bannerman took a similar position, saying that, "We'll do what the risk assessment dictates."

Many of those at the San Antonio meeting see the future of funding for EMF research as dependent on the outcomes of a few ongoing studies. As Rolf Lindgren of Vattenfall, Sweden's principal power company, in Göteborg, noted, "We are waiting for the Karolinska breast cancer study. If that fails to find a link to EMFs, it will be very hard to raise money for further studies."

the results of the three upcoming epidemiological studies should help clarify the childhood cancer issue," said Dr. Mary McBride of the British Columbia Cancer Agency in Canada. McBride is leading a major study in Canada, which she expects to release next year. Also due in 1997 is the study by the NCI (see *MWN,* J/F89). A U.K. report is expected in 1998 (see *MWN,* J/A91 and M/A92).

The findings of the NAS-NRC report stand in sharp contrast to two officially unfinished EMF reviews. In 1990, the Environmental Protection Agency (EPA) concluded that EMFs should be classified as a "probable human carcinogen" (see *MWN,* M/J 90). After extensive criticism, the EPA report was completely revised. But the agency has refused to release it, at least in part because of pressure from industry (see *MWN,* M/A95).

In an unpublished letter to the *Washington Post* dated Novem-

What They Are Saying

"There is a statistical association between living near a power line and an increased incidence of childhood leukemia. That's for sure. The question is what caused that association."

—Dr. Charles Stevens, NAS-NRC panel chair, on *Living on Earth,* broadcast on National Public Radio, November 10, 1996

"Compared to other things you might worry about or spend money on, [EMF research] doesn't look to me like the best one to spend it on. If you have money to spend, spend it on breast cancer or smoking."

—Dr. John Waugh, NAS-NRC panel member, MIT, quoted in the *Boston Globe,* November 1, 1996

"People may interpret the report [to mean] the matter is settled, but we don't think it is."

—Dr. Richard Luben, NAS-NRC panel member, University of California, Riverside, quoted in *Science,* November 8, 1996

"I paid dearly for being out there on the front line....I don't believe the [NAS-NRC] report....Unfortunately, not every scientist is unbiased. I just don't want to mess with this thing anymore."

—Dr. Robert Becker, author of *The Body Electric* and *Cross Currents,* quoted in the *San Francisco Examiner,* November 1, 1996

Junk science has no place in the media, public policy arena or the courtroom. Hopefully, the NRC report will help short-circuit future scares over minuscule environmental risks in the modern world.

—Editorial, *Seattle Times,* November 7, 1996

"If [ongoing EMF studies] came in positive, the NRC report would be out of date immediately."

—Dr. Gary Boorman, National Institute of Environmental Health Sciences, manager of the RAPID program, quoted in the *Philadelphia Inquirer,* November 1, 1996

"This report confirms what our position has been for some time."

—Eric Schmitt, spokesperson, TU Electric, a Texas utility, quoted in the *Dallas Morning News,* November 1, 1996

"We went through this with cigarette smoking for many years and then with asbestos....there may be no absolute evidence, but there is compelling evidence that there is a problem."

—Shirley Linde, chair, National EMF Advisory Committee, quoted in the Baltimore *Sun,* November 1, 1996

Opponents of power lines have invested too much emotion to give up their cause, but the scientific process seems at least to have sorted out the truth from the scaremongering.

—Dr. Robert Park, American Physical Society, op-ed article, *New York Times,* November 13, 1996

There is not enough evidence to convict electromagnetic fields beyond a reasonable doubt, but there is every reason to view them as a prime suspect.

—Dr. Louis Slesin, *Microwave News,* letter, *New York Times,* November 18, 1996

"[The report] should allay some concerns but may not put the issue to rest, as is the case with most scientific controversies."

—Madalyn Cafruny, American Public Power Association, quoted in the *New York Times,* November 1, 1996

"There is no conclusive evidence that there *isn't* a problem."

—Dr. Keith Florig, Carnegie-Mellon University, quoted in *Newsweek,* November 11, 1996

ber 6, Dr. Robert McGaughy, writing as a private citizen, chastised the NAS for misleading the public "into what may be a false sense of security." McGaughy has led the EPA assessment of EMF cancer risks for more than a decade.

Dr. Ross Adey, who has chaired a committee on EMF health effects for the National Council on Radiation Protection and Measurements (NCRP) over the last 12 years, had a more caustic view of the NAS-NRC report. "It fails to meet the most elemental responsibilities of the academy to itself or to the American public," Adey, of the VA Hospital in Loma Linda, CA, told *Microwave News.* The NCRP committee advocates strong action to reduce human exposures to EMFs, according to a draft report obtained by *Microwave News* last year (see *MWN,* J/A95).

A third review—carried out by the Oak Ridge Associated Universities (ORAU) for the White House science office, and commissioned in response to the EPA report—found "no convincing evidence" of an EMF health hazard (see *MWN,* N/D92). At the press conference, Stevens said that his committee was "more balanced" than either ORAU's review or the assessment by the American Physical Society, which also discounted health risks (see *MWN,* M/J95).

Undoubtedly, the most controversial aspect of the NAS-NRC report was the press release. Wertheimer, who lives in Boulder, CO, expressed frustration that the press release had failed to mention that the often-cited alternative risk factors, such as automobile traffic and the age of each house, had been tested and "have thus far *failed* quite uniformly to explain the wire code–leukemia link."

Committee member Dr. Richard Luben was also upset. "It's unfortunate that the NAS report turned into a media sound bite," he said in an interview. "We did not conclude that EMF exposure is safe. It is very clear that the committee did not write the press release."

"It would have been better if the press release had presented a more balanced view of the report," Wartenberg told *Microwave News.*

Views on the News: NAS-NRC *(continued from p.1)*

MWN, My85).

Others tried to redo the calculations. Eight years ago, Battelle's Dr. Thomas Tenforde trotted out some dubious assumptions by an obscure Australian researcher showing how the Wertheimer-Leeper and Savitz links to cancer could be made to disappear (see *MWN,* N/D88 and J/F89). No one was impressed and Tenforde's thesis was soon forgotten.

And there was Dr. Philip Cole's contention that the Wertheimer-Leeper and Savitz studies were not well controlled. His criticism could not be so easily dismissed, but Cole, the utilities' favorite expert witness, lost credibility when the Swedish study by Drs. Maria Feychting and Anders Ahlbom, using different techniques, confirmed the childhood cancer risk.

The NAS-NRC has now agreed that wire codes are linked to childhood cancer. This vindication of Wertheimer and Leeper was nearly lost in the headlines proclaiming that EMFs are safe.

The second argument, especially popular among some physicists, is that power-frequency fields have too little energy to promote cancer. This was also part of the NAS-NRC's logic.

But there are many biological realities that physicists can't yet explain. The most obvious EMF example is the demonstrated ability of some animals to sense infinitesimal fields—which are even weaker than those implicated by Wertheimer and Leeper.

Even if these physicists are right about 60 Hz fields, their objections don't apply to electromagnetic transients—short, intense pulses of energy. As Dr. Antonio Sastre, now at the Midwest Research Institute, told us last year, "pedestrian physics" can show that transients are strong enough to rise above the "background noise" of normal cellular activity (see *MWN,* J/A95).

Enertech Consultants measured transients in homes and found that they were more common near high-current power lines; that is, the transients were associated with wire codes (see *MWN,* S/O 95). When Sastre's models are coupled with Enertech's measurements, the physicists' objections turn fatuous.

The key idea here is that EMFs are more than just power-frequency magnetic fields. There are many different types of EMFs and limiting the analysis to one—the weakest—is disingenuous. Long ago, Dr. Ross Adey warned that EMFs in the real world are not well represented by nice, clean 60 Hz sine waves (see *MWN,* D83).

As committee member Dr. Daniel Driscoll told *Microwave News,* "My gut feeling is that it is EMFs—but we are not measuring magnetic fields correctly yet—and that there is some aspect of EMFs that will correlate very well with childhood leukemia."

This brings us back to factor X. The third argument is that wire codes are surrogates not for EMFs, but for something else, because measured fields are not associated with cancer. Dr. Robert Park, the physicist, says it's poverty; Dr. Howard Wachtel, the electrical engineer, says it's air pollution; others have their own ideas.

But in a letter to the *New York Times* (November 19), Drs. Richard Luben and Daniel Wartenberg, two members of the NAS-NRC committee, said Park has gotten it backwards: "What little data on poverty and EMFs exist suggest that poverty is associated with the absence of electric power transmission lines."

Wachtel of the University of Colorado, Boulder, presented his latest paper on the role of traffic in a lighthearted fashion at this year's DOE meeting. It had a curious ring. Air pollution was indeed a risk factor for childhood cancer—but only for those who lived well away from it. Up close, there was no link! Certainly, a counterintuitive finding—but not one that appeared to worry Wachtel or his coauthor, EPRI's Dr. Kristie Ebi.

Feychting, who at one point shared the stage with Wachtel in San Antonio, gently but emphatically told him that she and Ahlbom had gone to great lengths to see if air pollution was the missing risk factor but had found no support for the idea.

Savitz had himself looked at potential confounding from traffic and discounted the idea years ago (see *MWN,* J/F90). Today, Savitz remains unmoved by Wachtel's analysis. "I stand by our published results," he said.

But some members of the NAS-NRC committee continue to think a risk factor is lurking somewhere out of sight. Dr. Charles Stevens, the panel chair, is among them. "So far, there's only been one risk factor that's been evaluated, and that's electromagnetic fields—and there's no evidence at all, not a bit, that EMFs are the risk factor," Stevens said in a November 8 interview with WBUR, a National Public Radio station in Boston.

Really? Perhaps Stevens never read key parts of his own report and dozed through the committee's discussions. After all, the report states that, "Past efforts to identify [other risk factors] have failed and few strong candidates can be postulated at present." We asked Driscoll, who helped draft the NAS-NRC's chapter on epidemiology, how Stevens could make such a comment. "I can't explain it," Driscoll replied.

The NAS-NRC panel cited two reasons for finding EMFs not guilty and continuing the search for factor X: the lack of an association with spot magnetic field measurements and the lack of a dose–response relationship.

The absence of an association with a single 60 Hz magnetic field measurement taken up to 30 years after a cancer diagnosis should not be surprising. It is like testing paint chips in a home a generation after a child has suffered from lead poisoning.

When Feychting and Ahlbom calculated what the residential fields would have been at the time of diagnosis, using power consumption records, they did find an association and they did find a dose–response relationship (see *MWN,* S/O92).

One of the best reasons to suspect that EMFs are responsible for the childhood cancers—as many members of the committee do—is that whatever factor X might be, it would not be likely to play a role in occupational environments. "If both research avenues have been misleading, they have been so in different ways," the NAS-NRC panelists wrote in their report.

In fact, the committee acknowledged that workplace studies "have increased rather than diminished the likelihood of an association between occupational exposure to [EMFs] and cancer." Why then did the committee only do what Savitz called a "superficial overview" of this literature? The official answer is that it was not directly relevant to the committe's assignment.

"I can't imagine how anyone could consider the residential data without also considering the extensive occupational data set," commented Dr. Samuel Milham, of Olympia, WA, who in 1982 first reported an EMF–leukemia risk among workers.

It all comes down to the fact that the panel insisted on *conclusive* evidence of an EMF–cancer link. If such evidence already existed, there would have been no need for the NAS-NRC report, as DOE's Dr. Imre Gyuk has pointed out. The U.S. Congress requested the study in 1991 because of an already growing body of troubling data—and that was more than a year before the Feychting-Ahlbom results were announced. The report cannot make that data disappear.

The NAS-NRC report may mislead the public into a false sense of security—for a while. But the real link between power lines and cancer must still be addressed, as must the evidence that points to EMFs.

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« Cellular Phone Notes »

After **WTR** was named as a defendant in two cellular phone lawsuits, the **CTIA** agreed to pay its research group's legal expenses (see *MWN,* M/A95, J/F96, M/J96 and J/A96). Since then, WTR has tried to persuade the CTIA to indemnify WTR staff and researchers against *all* future damage awards and legal costs. In early October, WTR Chair Dr. **George Carlo** warned that without this protection, research could not proceed. The group's public affairs manager, **Susan O'Donnell**, explained that the lack of an agreement "would leave George open to being involved with litigation for years to come, even after WTR is over and done with." In an interview at the end of October, Carlo said, "We are exploring every avenue to resolve this dispute—and it is a dispute." CTIA's **Tim Ayers** responded that, "What we need is something that provides protection for everybody, and I think we're moving towards that." Both Ayers and Carlo indicated that one option under discussion was for the CTIA to buy additional insurance coverage for WTR, and Carlo revealed that Lloyd's of London is willing to provide it for "a couple of hundred thousand dollars a year." WTR's legal bills to date total about $600,000. On December 3, CTIA's board of directors approved "the outline of a contract with WTR for reimbursing WTR's legal expenses through insurance and other means." Carlo, however, indicated that negotiations were still continuing.

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Cellular phone companies are finding antenna siting to be difficult even with the support of the President and Congress. Prompted by an executive order from President Clinton and the 1996 telecom law (see *MWN,* S/O95 and M/A96), the **U.S. Postal Service** signed a contract with **Unisite Inc.** to find sites for tens of thousands of antennas across the country. The Postal Service entered the partnership hoping for a financial windfall, with rents from the antennas helping to stabilize postage rates. But at least two communities have contended that—contrary to instructions from Washington—the Postal Service and Unisite have not followed state and local siting regulations. Unisite is based in Richardson, TX, and headed by **Mark Fowler**, a former chairman of the FCC. In September, the town of **Schaumburg**, a suburb of Chicago, filed a lawsuit against the Postal Service for building a 100-foot tower without permission. "Our issue isn't the fact that they are installing antennas as much as the Postal Service feeling they don't have to go through the hearing process," Tom Dabareiner, Schaumburg's acting director of planning, said in an interview. Before the case was scheduled to begin, however, Unisite agreed to file for a special use permit, according to a Postal Service spokesperson. Last June, town officials in **Half Moon Bay, CA**, discovered that Unisite was planning to build a tower on their local post office. Company representatives would neither show them plans nor answer their questions, according to Chris Gustin, the town's planning and building director. "They just came in and tried to muscle us," Gustin said in an interview, noting that access to the proposed site would require permission from both the town and the state. Gustin added that the small town of 9,500 was not opposed to having wireless facilities, but that Unisite did not go through the proper channels for approval. "Modern technology is going to catch up to us sooner or later—I just don't think it needs to be in the form of a 150-foot tower," he said. Fowler told *Microwave News* that the company was in negotiations with Half Moon Bay officials.

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Long before health risks due to cellular phones became an issue, two conglomerates received **Japanese patents** for techniques to reduce users' exposure to RF/MW radiation. **Hitachi** received a patent (No. JP03-238936) on October 24, 1991, for a telephone designed "to prevent the health of the user from being injured." To avoid the absorption of RF/MW radiation in the user's head, the transmitting antenna is placed near the mouthpiece, rather than near the earpiece. The designers also included built-in shielding near the microphone. Similarly, **Mitsubishi** was issued a patent (No. JP04-220851) on August 11, 1992, for a "cordless" telephone designed to "reduce the effect of an electromagnetic wave onto a head of a human body." The handset is coated with shielding material on the side closest to the user's head.

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Medina, WA, the posh Seattle suburb that is home to Microsoft CEO Bill Gates, has been one of the most active communities in the U.S. in dealing with the siting of wireless facilities. In October, the city council passed a six-month moratorium on new antenna applications—its second this year. The first was issued in February and was allowed to expire in July when the city adopted an ordinance that established standards and requirements for antenna siting. The city council found that even with the ordinance in place, community concerns remained (see *MWN,* S/O96). The new moratorium will allow officials to evaluate effects on property values, choose a method for measuring RF/MW radiation,

New Book on Cell Phone Safety

Cellular phone health issues are given their most thorough examination to date in *Mobile Communications Safety,* edited by Drs. Niels Kuster of the ETH in Zurich, Switzerland, Quirino Balzano of Motorola in Ft. Lauderdale, FL, and James Lin of the University of Illinois, Chicago. The book grew out of a symposium held in Copenhagen, Denmark, in June 1994 (see *MWN,* J/A94).

The volume includes descriptions of ongoing studies, as well as results of past biological and epidemiological research. Other chapters feature detailed discussions of international standards, analyses of dosimetry issues (both experimental approaches and mathematical models) and an overview of interference with medical devices.

To be published in January 1997 by Chapman & Hall, the book can be ordered in the U.S. for $74.95, plus shipping and handling, from: International Thomson Publishers, PO Box 6904, Florence, KY 41022, (800) 842-3636, Fax: (606) 525-7778. For international ordering information, check Chapman & Hall's Web site at: <www.chaphall.com/chaphall.html>.

review other ordinances, discuss changing zoning codes to address local concerns and reconsider using city parks for wireless sites. Medina officials are apparently not worried about industry reaction, since a federal judge ruled in a case brought by **Sprint Spectrum** (see *MWN,* M/J96) that the first moratorium did not violate the telecom law. City Attorney **Kirk Wines** told *Microwave News* that two Sprint antenna applications have been turned down since the second moratorium was adopted, but no lawsuits have been filed as a result. In the same Seattle courthouse in which Medina prevailed over Sprint, **US West** has charged that a moratorium which was passed by the **San Juan Islands, WA**, violates the telecom law (see *MWN,* S/O96). A decision is still pending. In September, **BellSouth** won a lawsuit in which a U.S. District Court judge ruled that **Gwinett County, GA**, had not supported its decision to deny a tower site with a written record, as required by the telecom law.

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The October 1996 issue of ***IEEE Transactions on Microwave Theory and Techniques*** features papers from **Canada, Japan, Switzerland** and the **U.S.** on the distribution of cellular phone radiation in the human head. A team from Nagoya Institute of Technology, Tokyo Metropolitan University and NTT Mobile Communications Network Inc. reported that the maximum energy absorption calculated with computer models is significantly higher than that estimated with experimental techniques.

Reports of Headaches Emerge Among Cell Phone Users in U.S.

Last year occupational health specialists in Australia, Sweden and the U.K. noted a number of reports of headaches associated with the use of cellular phones. Now such complaints are emerging in the U.S. as well.

Both the National Institute for Occupational Safety and Health (NIOSH) and the Food and Drug Administration (FDA) have received several reports linking cellular phones and headaches, and the issue is now on the agenda of an informal interagency group dealing with cellular phone health issues.

"Headaches have been the main thing we've heard about, but we have also heard [other] complaints: some people getting just headaches, others complaining about headaches and problems of dizziness or just not feeling quite the same," Dr. Linda Rosenstock, director of NIOSH in Washington, told CNN in November.

Dr. Ron Kaczmarek of FDA's Center for Devices and Radiological Health in Rockville, MD, told *Microwave News* that the FDA knew of about a dozen possible cases altogether. "The case reports by themselves don't tell you much," he said. "There are several million cellular phone users, so it's not surprising that headaches would occur among them." But Kaczmarek said that the FDA will monitor the issue, and is particularly interested in the ongoing Scandinavian epidemiological study (see box at right).

The federal interagency group first discussed the headache question at its meeting in August and held a session devoted to the issue in late October. "It was primarily an information-sharing meeting," according to Dr. Gregory Lotz, the chief of NIOSH's Physical Agents Effects Branch. "We discussed whether this was important enough to investigate, and there was a consensus that it was." Representatives of the Environmental Protection Agency, the FDA and the industry group WTR also participated in the October meeting and held a teleconference with Sweden's Dr. Kjell Hansson Mild to hear about his current work.

"None of us have the resources to do anything in addition to the European efforts," said Lotz from his office in Cincinnati, "but we're eager to stay abreast of what's going on." Both Lotz and Kaczmarek indicated that the interagency group will return to the headache issue next year, when Mild's results are available.

Dr. George Carlo, the Washington-based chair of WTR, said in an interview that the initial reports in the U.S. so far seem to involve more digital than analog phones. Last year a Swedish researcher described the same apparent trend in complaints in his country (see *MWN,* N/D95). Kaczmarek said that in the cases of which the FDA was aware, the agency did not have information on the types of phones involved.

Lotz noted that at the October 25 meeting there had been some concern that widespread news of this research could itself cause an increase in cellular phone/headache reports. "The Swedes are hoping to beat that curve," he said. "The subjective nature of headaches makes this harder to study," commented FDA's Kaczmarek. "But it's not impossible—just more difficult."

The current issue of *Electro- and Magnetobiology (15,* pp. 253-258, 1996) features a paper showing how microwave radiation can affect electrical activity in the brain, by Drs. R.A. Chizhenkova and A.A. Safroshkina of the Institute of Cell Biophysics in Pushchino, Russia. Soviet and other East European researchers had reported an association between microwave exposure and headaches in numerous studies in the 1960s and 1970s, mainly among radar workers. The headaches were often linked to other subjective symptoms, such as irritability, fatigue, nausea and sleep disturbances. These studies were reviewed 20 years ago in *Biological Effects of Microwaves* by Drs. S. Baranski and P. Czerski—but they have received little attention in the U.S.

Scandinavian Headache Study

Dr. Kjell Hansson Mild of the National Institute for Working Life in Umeå, Sweden, is in the midst of an epidemiological study that is examining whether there is a connection between cellular phone use and the incidence of headaches.

"We are looking at subjective disorders in general," Mild told *Microwave News,* "such as headaches, memory loss, etc. We want to find out if these symptoms are connected to phone use, and, if so, which parameters are most important."

Mild is collaborating on the study with Gunnhild Oftedal of the Norwegian phone company Telenor in Trondheim. The project involves 12,000 subjects in Sweden and 5,000 in Norway. The researchers are starting to receive the first completed questionnaires and will begin analyzing the data sometime after mid-January. They do not expect to have results before the *2nd World Congress for Electricity and Magnetism in Biology and Medicine,* which will be held in June 1997 in Bologna, Italy (see p.17).

Mild is a member of the European Commission's expert group on mobile phone safety (see *MWN,* N/D95).

Cell Phone Industry on How To Avoid Pacemaker EMI: User Precautions for Now, Better Shielding in Future

The Cellular Telecommunications Industry Association (CTIA) and its research group, Wireless Technology Research (WTR), have come out in support of a range of actions to avoid electromagnetic interference (EMI) with cardiac pacemakers. They emphasize the need for precautions by users in the short run, and look to changes in pacemaker design as a long-term solution. These measures were advocated in a report that was the centerpiece of a WTR conference in Washington on September 30 (see below).

"We are pleased with the success we've had with the pacemaker interference program and consider our role to be finished," WTR Chair Dr. George Carlo told *Microwave News.* "Implementation of our recommendations is now the purview and responsibility of the wireless and pacemaker industries."

The CTIA supports all of WTR's recommendations, according to spokesperson Tim Ayers in Washington. A statement from CTIA President Thomas Wheeler asserted that the cellular phone industry "has provided a model of how an industry can and should handle a potential health issue."

"We are basically pleased with the report," said Bernard Liebler of the Health Industry Manufacturers Association (HIMA), a Washington-based trade group of medical device makers. Liebler called the document "reasonably evenhanded," and said, "The most important thing is that we're talking to each other."

The U.S. Food and Drug Administration (FDA) generally supports "the kinds of recommendations that WTR is making," FDA's Don Witters told *Microwave News.* WTR's guidelines for pacemaker users incorporate many points from earlier statements by the FDA, HIMA and Health Canada, the Canadian government's health agency.

"I'm very happy to notice a change in both industries," commented Dr. Roger Carrillo of Mt. Sinai Medical Center in Miami Beach, FL, who began research on the issue in 1993 and eventually received some funding from WTR (see *MWN,* M/J95; also N/D95 and M/J96). "Now both are concerned about the possibility of conflict—we have wireless manufacturers thinking, 'Will

WTR Recommendations for...

Pacemaker Users:

• Wireless phones should be kept at a safe distance from a pacemaker. Existing data indicate that the greater the distance between a pacemaker and a wireless phone, the less the risk of EMI and that six inches is the proper separation distance for minimal risk. Practical steps to achieve this separation include: (i) The phone should not be placed over the pacemaker, such as in the breast pocket, when it is in the ON position; (ii) The phone should be used at the ear opposite to the pacemaker.

Physicians:

• A process should be established for educating cardiologists and other physicians regarding the data about the risks of EMI between pacemakers and wireless phones so that they are equipped to advise their patients about the risks of interference. Specifically, physicians should be aware that: (i) Pacemaker-dependent patients have a higher risk of clinically significant EMI; (ii) Analog phones are associated with a low incidence of EMI; (iii) Some pacemakers are resistant to EMI.

• Physicians should *not* conduct *ad hoc* testing of wireless phones and pacemakers.

Pacemaker Industry:

• Premarket screening of pacemakers should be expanded to include tests for potential EMI from the emissions from wireless phones.

• EMI standards for premarket screening of wireless phones should be established. The WTR/FDA screening working group has established that *in vitro* testing is a useful tool for predicting clinically significant EMI between pacemakers and wireless hand-held phones.

• Pacemaker manufacturers should include labeling that details the results of pacemaker/phone EMI research and current recommendations for mitigation.

• Monitoring of EMI cases should be incorporated into the industry's current postmarketing surveillance practices for pacemakers.

• Pacemaker manufacturers should use shielding and filtering techniques in the design of future pacemakers, and should encourage the use of pacemakers already EMI-resistant for patients who use wireless phones.

• The industry should continue research on, and development of, successful design features that prevent EMI.

Wireless Telephone Industry:

• Wireless phone manufacturers should expand existing informational inserts included in wireless phone packaging to detail the results of phone/pacemaker EMI research and current recommendations for mitigation.

• The wireless phone industry should make details of phone specifications readily available to the pacemaker industry and the public to facilitate effective screening for EMI. Specifically, EM emissions should be available to the pacemaker industry and whether the phone is analog or digital should be available to the public.

• The wireless phone industry should continue to participate in standards committees, such as those affiliated with ANSI, AAMI and IEC, to facilitate the development of adequate EMI standards.

• The wireless phone industry should continue to evaluate potential pacemaker EMI when developing future technology.

• The wireless phone industry should study the effects of phone EM emissions characteristics on EMI.

• The wireless phone industry should continue to work with the FDA and the medical device industry regarding reported incidences of EMI between medical devices and wireless phones.

Wireless Phone/Pacemaker Industries Jointly:

• A forum for collaborative guided research between the wireless phone and pacemaker industries should be established.

Adapted from WTR's *Evaluation of Interference Between Hand-Held Wireless Phones and Implanted Cardiac Pacemakers: Final Recommendations for Corrective Intervention,* released on September 30 in Washington.

my product interfere with some implanted medical device?' and vice versa. This was not the case a couple of years ago."

WTR's report urged specific precautions such as a six-inch separation distance between cellular phones and implanted pacemakers (see below). It noted that wider use of pacemakers that are resistant to EMI could drastically reduce the problem in the future. But since "hardening techniques effective today may not be effective with technologies of the future," the report called on both the pacemaker and wireless industries to pay attention to the EMI problem as they design new products.

A May 10 letter from Carlo to the FDA had urged that "people who are dependent on their pacemakers...should use the more common analog-type phones" rather than digital models (see *MWN,* M/J96). WTR's final recommendations retreated somewhat from this position, noting only that doctors "should be made aware" that analog phones cause much less interference. "We decided just to give physicians all the relevant information," Carlo explained, "so that they can assess the needs of their individual patients."

A WTR study of 975 pacemaker users had previously found that the PCS-1900 type of digital phones produced very little interference (see *MWN,* M/J96; also M/J95 and N/D95). The Center for Electromagnetic Compatibility (EMC) at the University of Oklahoma, Norman, reported a similar finding at the September 30 WTR conference. These phones provide what the industry calls "personal communications services" (PCS), integrating telephone, paging and voice mail, and transmitting at a higher frequency of around 1900 MHz.

But the final WTR report noted that PCS-1900 phones are just now coming to market and have only been studied in "test mode"—not in the discontinuous transmission (DTX) mode, which customers use for making phone calls. European GSM phones with DTX have been reported to cause interference. "It is therefore important," the report stated, "that the PCS-1900 phones be studied further in actual transmission."

The report also called on the cellular phone and cardiac pacing industries to support more research on EMI to cardiac defibrillators. "We firmly believe that follow-up *clinical* studies of defibrillators must be done," Carlo told *Microwave News.* "Unfortunately, WTR has not been funded to accomplish this very important work."

WTR had planned to sponsor a study of defibrillator wearers by Dr. Hans Moore of George Washington University (GWU) in Washington (see *MWN,* N/D95), but was unable to work out the details before funding problems with the CTIA forced a cutback (see *MWN,* M/J96 and J/A96). "We do not have funding for a research agenda on defibrillators," said CTIA's Ayers, "but we'll continue to cooperate with the FDA and others researching the issue."

Witters explained that due to funding cutbacks at the FDA, its main focus on defibrillator EMI would be to continue laboratory testing. As for studies with people who have implanted defibrillators, he said the FDA would probably do some work with Moore at GWU. He added that the FDA was already looking into PCS-1900 phones and may collaborate on a clinical study with scientists at Johns Hopkins University in Baltimore and corporate researchers from Sprint PCS, Sprint Spectrum's new corporate name.

The WTR report ended by urging the wireless and pacemaker industries to establish "a forum for collaborative guided research," and CTIA's Wheeler stated that the University of Oklahoma's EMC Center "will provide the forum for the future exchange of information between the two industries." But HIMA's Liebler declined to endorse Wheeler's view: "Oklahoma is one place, and certainly they did good work, but I can't speak for the pacer companies on that. That's a business decision."

Dr. Ravi Ravindran, director of the Oklahoma center, and Dr. Hank Grant, chair of its board, said in an interview that the center is planning laboratory research on cardiac defibrillators and on pacemakers with PCS-1900 phones. They added that they know of no institution with definite plans for clinical studies of people using these devices.

Cell Phones and Pacemakers: How Close Is Safe?

A consensus has formed in support of six inches as a minimum "safe separation distance" between pacemakers and cellular phones. But EMI is possible, though rare, even at greater distances, according to several researchers.

Preliminary data from recent work by Dr. Roger Carrillo "support a six-to-eight-inch threshold for interference," according to WTR's report. However, the report's recommendations called for only a six-inch separation.

"The effects that could pose a major risk to the patient all occurred within a range of three inches," Dr. Carrillo told *MicrowaveNews,* adding that 99% of interference of any kind happens within six inches. "There are some less clinically significant events that may occur beyond that range, but as a doctor I'm especially concerned about the significant events. A skipped beat here or there is not a major problem."

WTR's Dr. George Carlo said in an interview that he had originally suggested specifying "six-to-eight inches." But he explained that peer reviewers at the Harvard Center for Risk Analysis in Boston, among others, had said a more definite number was needed, and that six inches should be adequate. The WTR report stated that with a six-inch separation, "approximately 99% of pacemaker wearers would be protected."

Dr. Kok-Swang Tan, a research scientist with Health Canada's Health Protection Branch (HPB), found one pacemaker that was affected at 12 inches. "It's not only myself," he told *Microwave News.* "The U.S. FDA and the University of Oklahoma center also found examples of EMI beyond six inches." Although the HPB has not endorsed any particular separation distance, Tan personally argued at the WTR meeting for consideration of a greater threshold.

But Tan said that others at the conference expressed "a clear consensus to stick with the six inches." Both the FDA and HIMA support a six-inch separation. Given that the six-inch guideline now has such wide support, Tan said that he would not necessarily oppose its adoption by the HPB in the future.

Local Autonomy for Siting Cellular Towers in New Zealand

In contrast to the U.S., where a national radiofrequency and microwave (RF/MW) radiation standard has preempted state and local government rules for cellular tower siting (see *MWN,* M/A 96 and M/J96), communities in New Zealand have adopted a variety of policies, including a 50 ∝W/cm^2 public exposure limit and a minimum distance between antennas and homes.

New Zealand has a tradition of public participation in environmental issues, and this has encouraged local governments to be involved in siting decisions for cellular antennas, a process that some say is working well.

"Where a local authority has developed a policy on transmission sites, public concern has generally been met," according to *Public Authority Planning for Cell Phone Transmission Facilities,* a report released by the office of New Zealand's Parliamentary Commissioner for the Environment in September.

On the other hand, New Zealand's wireless industry—comprised of three providers: Telecom New Zealand, a subsidiary of the U.S.'s BellSouth and Australia's Telstra—has been critical of the local councils, arguing that they have developed inconsistent policies.

The environment commissioner, Helen Hughes, recommends that local governments pursue a "prudent approach" for setting RF/MW radiation exposure limits for cellular towers, develop plans to protect both community concerns and industry interests, take into account high-risk groups when setting exposure limits for the public and devise strategies for monitoring RF/MW exposures.

New Zealand's Resource Management Act of 1991, which allows local governments to formulate their own environmental plans, has brought about a diversity of siting policies:

- The city of Auckland has adopted a 50 ∝W/cm^2 exposure limit, which is stricter than the 200 ∝W/cm^2 advisory guideline New Zealand adopted in 1990.
- The city of Christchurch has maintained discretion as to whether transmitters may be erected within 300 meters of residential areas or entail exposures exceeding 50 ∝W/cm^2.
- The city of Hutt requires that wireless companies get consent for any facilities sited outside industrial locations and then only if they can demonstrate that their transmitters comply with the New Zealand standard.
- The district of New Plymouth permits antennas in industrial areas, but requires the district's consent to site them in rural areas.
- The city of Waitakere, which was the first to adopt a bylaw with regard to RF/MW exposures, enforces the 1990 New Zealand standard for the general public.

Hughes suggests that the central government can assist local governments that do not want the burden of developing rules for antenna siting by setting guidelines and by urging industry to show that it is minimizing RF/MW exposures.

Although the report recognizes children as a risk group, it is silent on the issue of siting antennas near schools. New Zealand's Ministry of Health issued a report in August favoring prudent avoidance where children are concerned (see box at left). Earlier this year, New Zealand's Ministry of Education issued a policy statement banning the placement of cellular antennas near public schools (see *MWN,* S/O96).

New Zealand: More RF/MW Health Studies "Imperative"

An independent report commissioned by New Zealand's Ministry of Health has called for more research to examine the potential health effects from exposure to RF/MW radiation. In the interim the ministry advises taking "no-cost" measures to reduce exposures from wireless transmitters—especially for potentially sensitive groups such as children.

"It is imperative that the scientific issues be clarified as soon as possible, as there is much at stake," according to a report, *Literature Review on the Health Effects of RF Radiation,* which was published in August for in-house policy-making and is available on request. Reviews in Australia, Europe and the U.S. have reached similar conclusions (see *MWN,* S/O94 and S/O95).

The report, by Dr. Michael Bates of the Institute of Environmental Science and Research in Porirua and Drs. Marten Hutt and Alistair Woodward of the Wellington School of Medicine, cautioned policy-makers not to use the limited information on nonthermal RF/MW interaction to dismiss potential health effects: "[T]here is a high level of scientific uncertainty, and the implications for policy-making depend largely on where the onus of proof lies: the epidemiological evidence may be construed as either 'incomplete evidence of cause' *or* 'incomplete evidence of safety.'"

The authors added that while there are no widely accepted biological mechanisms to explain health effects, it would be premature to dismiss these effects as biologically implausible.

The review turned up strong evidence for electromagnetic interference with medical devices, but a dearth of research to link RF/MW exposure to leukemia, brain and lung cancers and effects on the blood, chromosomes, eyes and cardiovascular system. Additionally, studies on the female reproductive and nervous systems are inconclusive, according to the report.

Belgian Study: Tower Radiation Strengthens Chemical Mutagen

A Belgian research team has found that very-close-range exposure to microwaves from a cellular telephone base station increases the effect of a chemical mutagen on human blood cells.

"A genotoxic effect was demonstrated in *in vitro*-exposed human blood cells, as indicated by an elevated frequency of cells with chromosomal aberrations," a team led by Drs. Annemarie Maes and Luc Verschaeve wrote in *Environmental and Molecular Mutagenesis (28,* pp.26-30, 1996).

Whole blood samples were exposed to 954 MHz microwaves from an actual GSM base station and then to the "DNA damaging agent" mitomycin C (MMC). Other samples were exposed to either the microwaves or MMC alone. Exposure to the microwaves alone had no mutagenic effect. But blood samples exposed to the microwaves and then to MMC showed a "considerably higher" and statistically significant number of chromosomal abnormalities than those exposed only to MMC.

Microwave exposure increased the subsequent effect of MMC by approximately 20-50%. The greatest impact of prior microwave exposure appeared to occur when the highest concentration of MMC was administered.

The blood samples were exposed to the microwaves for two hours at a distance of 5 cm from an antenna with a 15 W power output, resulting in a specific absorption rate (SAR) of 1.5 W/Kg.

"No cytogenic damage was observed in cells placed at 10 cm or longer distances from the emitting antenna," according to the study, which noted that while the general public is always more than 10 cm away from the antennas of cellular phone base stations, such is not the case for telecommunications workers.

The researchers stressed that this does not prove that microwave radiation promotes cancer—but they concluded that "this possibility must be taken into serious consideration," since "genetic effects are very often directly linked to carcinogenesis."

They are currently investigating whether the radiation emitted by cellular phones themselves plays a similar synergistic role with any of several different chemicals. They cautioned that the results from exposure to base station signals cannot be extrapolated to exposure from phones.

Maes and Verschaeve are both at VITO, the Flemish Technological Research Institute in Brussels. Verschaeve is a member of the European Commission's expert group on cellular phone health effects research (see *MWN,* N/D95).

Australia To Study the Health Impacts of Wireless Technology

The Australian government will sponsor a five-year, $3.5 million project on potential health effects of mobile phone technology. The new initiative will include a research program, support for the ongoing World Health Organization effort and dissemination of information on RF/MW radiation.

"An important part of this project will be the provision of factual information about the use of mobile phones and about exposure levels," Dr. Michael Wooldridge, minister for health and family services, said in a statement. Senator Richard Alston, minister for communications and the arts, stressed the need to respond to public concern about possible effects from long-term exposure to RF/MW radiation, especially on children.

Australia's National Health and Medical Research Council will coordinate the research program with the help of a committee that will likely include representatives from the Australian Radiation Laboratory, the Commonwealth Scientific Industrial Research Organization (CSIRO) and the Department of Communications and the Arts. The telecommunications industry will face an increase in licensing fees to cover the project, which will cost 4.5 million Australian dollars.

The project was prompted in part by a 1995 Spectrum Management Agency report by Dr. Stan Barnett of CSIRO, which recommended that Australia establish a research program to bring about "relevant and focused research" (see *MWN,* S/O95), according to a spokesperson for Senator Lyn Allison in Victoria.

In an interview, however, Barnett cautioned that enthusiasm for the new project may cause the funds to be spread over several small studies in the hope of achieving a big research effort, thereby running the risk of "spurious, possibly false-positive results."

While Barnett initially favored an Australian program, he is now seeking the involvement of other research centers—including some in the U.S.—to provide the "wide base of technical expertise" he feels is necessary. "I believe that the perception of a health risk related to telecommunications is a global problem and that effective research programs should be undertaken by international collaboration," he said.

Australia has recently proposed a new Telecommunications National Code, which would restrict the ability of local governments to regulate tower siting, according to the inaugural issue of *Electromagnetics Australia/New Zealand.* The newsletter's editor, Don Maisch, who is based in North Hobart on the island of Tasmania, reports that despite these restraints, one local council in Sydney has proposed a 0.1-0.2 $\propto W/cm^2$ exposure limit and the Queensland Democrats passed a motion opposing antennas near schools. Last year, after community protests, Telstra, a telecommunications company, shut down a transmitter in Sydney that was located near a kindergarten and baby health care center (see *MWN,* N/D95).

"MICROWAVE NEWS" FLASHBACK

Years 15 Ago

• The family of Seaman Charles Day attempts to file suit against the U.S. government over the 19-year-old's "wrongful" death from cardiac arrythmia while serving in the Navy. Although the Navy refuses to reveal the nature of his work, the *Providence Sunday Journal* reports that Day installed microwave equipment.

• Senior EPA officials weigh issuing non-ionizing radiation safety standards for the general population.

• NIOSH fails to identify anything "unusual" about a cluster of six cancer cases among women working with RF sealers at the Beaverite Products plant in Beaver Falls, NY.

Years 10 Ago

• Dr. David Savitz stuns the DOE contractors review meeting when he announces that he has replicated the 1979 Wertheimer-Leeper study linking childhood cancer to power lines.

• A team of Italian researchers led by Dr. Santi Tofani observes serious reproductive and developmental effects—such as lower bodyweight gain and incomplete cranial ossification in fetuses—among rats exposed to extremely low levels of RF radiation.

• Drs. Ross Adey, Asher Sheppard and Samuel Milham take issue with a *Scientific American* article by Drs. Kenneth Foster and Bill Guy on rats exposed to RF/MW radiation. "[Foster and Guy's] apology for the elevated cancer incidence," Adey and Sheppard write, "has all the aspects of an option more often exercised by politicians: If the facts are unattractive, bury your head in the sand (i.e., statistics) and hope no one will notice the odd posture."

Years 5 Ago

• The IEEE approves a revision of the 1982 RF/MW safety standard.

• As concern over a possible police radar–cancer link mounts, the Connecticut police department bans hand-held radar units.

FROM THE FIELD

Letter to the Editor: Childhood Leukemia and Electric Fields

November 7, 1996

To the Editor:

I welcome your recent coverage of the importance of electric fields in EMF studies.[1,2]

I am a coauthor of the first childhood leukemia epidemiological study to have measured and reported both ELF magnetic *and* electric fields over a meaningful time period, instead of simply taking spot measurements, which can be misleading.[3] The fields were measured at the bedplaces of 56 cases and 56 controls overnight. We found a dose–response relationship, with a significant fivefold increase in the relative risk of developing leukemia [from] electric fields above 20 V/m, but no significant difference in the case of magnetic fields.

For many years now, Roger Coghill and I have been saying that electric field exposure is important. I designed the data-logging equipment used in our study six years ago, and we have been using it since then.

The large, ongoing U.K. Childhood Cancer Study (UKCCS) originally [did not] include electric fields because the U.K. National Radiological Protection Board (NRPB) had stated that they could not be quantified meaningfully in a bedroom setting. However, we and Dr. Alan Preece[2] managed to convince the NRPB that the measurements were possible and meaningful. The board has now designed an effective electric field probe assembly, which fits around an EMDEX II. This was tested earlier this year, and is now being used in the UKCCS Phase II measurements.

As there is no dependent relationship between ELF electric and magnetic field levels, this may explain the lack of consistent findings between studies [that] only consider magnetic fields.

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1. Anthony Miller et al., "Leukemia Following Occupational Exposure to 60 Hz Electric and Magnetic Fields Among Ontario Electric Utility Workers," *American Journal of Epidemiology, 144,* pp.150-160, July 15, 1996. See *MWN,* J/A96.
2. Alan Preece, Letter, *MWN,* p.15, S/O96.
3. R. Coghill, J. Steward and A. Philips, "Extra Low Frequency Electric and Magnetic Fields in the Bedplace of Children Diagnosed with Leukemia: A Case-Control Study," *European Journal of Cancer Prevention, 5,* pp.153-158, June 1996.

Clippings from All Over

"There are waves of health [alarms] that spread like locusts across the lands. I wrote the book because the breast implant story was the most extreme example, but by no means the only one. We can see it in electromagnetic fields, for example. People don't look at the evidence. They say, oh, my gosh, here's another health risk, here's something else that's going to kill me out there, and probably the big companies know about it, and probably the government is covering it up, I'd better go to court. There is that, that predilection. I think the media plays into it."

—Dr. Marcia Angell, executive editor of the *New England Journal of Medicine* and author of *Science on Trial: The Clash of Medical Evidence and the Law in the Breast Implant Case* (Norton, 1996), in an interview with David Gergen on PBS' *News Hour,* October 1, 1996

We have not committed, nor can we commit to complete, the full research agenda within the current financial or five-year time frame. Indeed, the task of completing the science embodied within the WTR research agenda may well fall to others when our commitment of five years is fulfilled or when the industry's financial commitment of $25 million is exhausted.

—Drs. George Carlo and Ian Munro of Wireless Technology Research (WTR) in Washington, DC, letter, "WTR Will Not Cut Corners on Study," *RCR (Radio Communications Report),* p.26, October 21, 1996

Probably the gravest mistake an attorney can make with respect to EMF litigation is to discount the potential effects and liabilities involved based upon the success of defendants to date....[O]n the experience gained from asbestos litigation, it is clear that what may start out as an apparent win-win situation for the attorney and the defendant/client can summarily be reversed. Another error in judgment would be to become overly enthusiastic about the present scientific opinions which currently support the defense's posture. Ultimately, these cases will be decided by the jurors' hearts and not their minds....As with asbestos litigation, it may take another ten years before EMF litigation finds its center.

—Donald L'Abbate of L'Abbate, Balkan, Colavita & Contini in Garden City, NY, "Electromagnetic Field Litigation: Developments—Lawyers Need Deeper Understanding," *New York Law Journal,* p.S6, October 15, 1996

[W]hile the lights have not gone out completely, in view of the currently inconclusive nature of the scientific evidence on EMF health effects, EMF property damage litigation in California courts retains but a flicker of life. It appears likely to fall to the federal courts, as the ultimate guardians of landowners' constitutional property rights, to decide either to revive the patient or pull the plug.

—Arthur Coon of Miller, Starr & Regalia in Walnut Creek, CA, "What You Can't See Can't Hurt You—Or Can It? The California Supreme Court Holds That Landowners Must Bear Losses in Property Value Caused by 'Intangible' EMF Intrusions," *California Environmental Law Reporter,* p.328, October 1996 (see also p.2)

Experience has shown that there will be a steady stream of "new information" as the scientific community explores the effects of RF radiation ....However, the industry cannot change course, or be subjected to a much stricter "as low as reasonably possible" standard, every time a new study is issued. This is especially true where it is not clear that the new information directly concerns the particular frequencies used by the wireless industry, and where the implications of the new information are not known. For example, the study cited by the Ad-Hoc Association concerning the effect of 900 MHz radiation on REM sleep may not reliably predict the impact of cellular operations on REM sleep....Billions of dollars are being invested in telecommunications infrastructure, and it is no simple matter to change out a telecommunications system in the wake of each new study. If this "assume the worst" approach were followed in all areas of environmental concern, everyone would be required to wear an oxygen mask, and drinking water would be declared off-limits.

—From *Comments of Ameritech Mobile Communications Inc. on Petitions for Reconsideration,* filed with the FCC by attorneys for Ameritech in Hoffman Estates, IL, October 8, 1996 (see also *MWN,* S/O96)

" We have come to the stage where we have got to say to the companies, 'The ball is in your court, it's up to you to prove safety,' rather than the researchers and consumers having to prove danger."

—Stewart Fist, writer and commentator on the communications industry, quoted by Ben Potter in " 'Ear, What's All this Fuss About Mobile Phones?" *The Guardian* (U.K.), November 14, 1996

Prudent Avoidance in Sweden: A Cost-Benefit Analysis

The following is excerpted from Low-Frequency Electric and Magnetic Fields: The Precautionary Principle for National Authorities, *a new pamphlet issued by the five agencies responsible for addressing EMF health risks in Sweden—the National Board of Health and Welfare; the National Board of Housing, Building and Planning; the National Board of Occupational Safety and Health; the National Electrical Safety Board; and the Radiation Protection Institute. All of these agencies have endorsed a policy of prudent avoidance (see* MWN, *N/D95; see also M/J94).*

The pamphlet provides some benchmarks for the cost of avoiding illness and death. In Sweden, the cost of preventing one statistical case of cancer from ionizing *radiation was estimated to be 12 million kronors (MSK), while avoiding one traffic death was estimated to cost 7 MSK. (1 MSK is approximately equal to $152,000 U.S.) Comparable values in the U.S. ranged from 5 MSK to 50 MSK, with the lowest estimates for traffic accidents and the highest for environmental protection and nuclear power policies, according to the pamphlet. It notes that in the U.S., "In the field of radiation protection, measures against ionizing radiation costing less than 5 MSK per statistical case avoided are looked on as urgently necessary."*

For a copy of the pamphlet, which is in English, contact the National Board of Occupational Safety and Health, S-171 84 Solna, Sweden, (46+8) 730-9000, Fax: (46+8) 730-1967.

On average in Sweden and most other industrialized countries, one child in 25,000 per annum develops leukemia. Although the hypothesis of the connection between the occurrence of childhood leukemia and exposure to magnetic fields cannot be deemed scientifically established, the observed risks are presumed valid in our examples. In one Swedish epidemiological survey, it was observed that children living close to power transmission lines ran a 2.7 higher risk of developing leukemia than those living a long way from such transmission lines. This figure has also been applied to transformer stations and stray currents in the following examples, for lack of other risk estimates. We also assume a lifetime of 40 years for the measure taken and an interest rate of 4%. On these assumptions, it can be shown that the cost per statistical case avoided will be R=735K/N [SK/case], where K is the cost of the measure taken and N the number of individuals whose exposures the measure [prevents]. Cost is only slightly affected by the lifetime chosen for the measure if it is long-lasting. If the lifetime of the measure is put at 80 years instead of 40, the estimated costs in the examples below will be 17% lower. It is not possible in these examples to make general allowance for the effects of different doses on the number of leukemia cases.

It has to be noted that our examples are only intended to illustrate a calculation model for arriving at a comparison between different costs. Depending on the circumstances of the individual cases, there may be other solutions or bases of economic calculation that are more appropriate.

...The examples show that exposure reduction measures can cost between a couple of million and several hundred million SK per statistical case of childhood leukemia avoided, subject to the risk estimates employed remaining valid. Note that the precautionary principle recommends that measures should be considered when the fields deviate strongly from what can be deemed normal in the environment concerned.

Power Line near Multifamily Dwellings:
An existing 220 kV power transmission line crosses a multifamily housing area with 300 children living within a distance of the line where the risk of childhood leukemia is presumed to be elevated by proximity to the power line. The cost of replacing the power line with another solution—laying a cable along an existing road—is 60 MSK. If this measure is taken, the cost per case avoided, assuming the estimated risk to be true, will be about 150 MSK. Calculations by local authorities may involve other aspects on which a value can be placed, e.g., the fact of land being released for alternative use.

Preschool near a Power Line:
A day nursery used every day by 40 children is so close to a power transmission line that the risk of childhood leukemia can be deemed elevated. The cost of building a new day nursery elsewhere is 4 MSK. If this measure is taken and there are no other economic aspects to be taken into consideration, the cost per case avoided will be 74 MSK. If instead it were possible to use tuned, screened circuits, at an estimated cost of 0.5 MSK, the cost per case would be about 9 MSK.

Transformer Station in a School Building:
A transformer station in a school building causes elevated magnetic fields in three classrooms. One possible means of reducing the magnetic fields is to line the space with sheet metal. A measure of this kind costs about 1,000 SK/m^2, materials and labor included, which can mean a total cost of about 0.2 MSK. Assuming the measure will reduce exposure for 75 children using the classrooms, the cost per case avoided will be less than 2 MSK.

Stray Currents in Single-Family Dwellings:
A single-family dwelling has elevated magnetic fields, which are presumed to augment the risk of childhood leukemia. These magnetic fields are caused by stray currents from installations in the house, and these currents will cost 5,000 SK to eliminate. Assuming that there will be, on average, one child living in the home over a period of 40 years, the cost per statistical case avoided will be about 4 MSK.

Power Line in Rural Area:
A 400 kV power transmission line is planned in a rural area. An effort was made at the planning stage to locate the line as favorably as possible, e.g., from the viewpoint of persons living close by. It is intended to use a power line structure, a T-pole, which is more advantageous from a magnetic field viewpoint than the traditional transmission line structure. These measures can be taken without any appreciable added expense or other consequences. Even so, for 80 km of its length, the line will pass within such a distance of 71 scattered properties that the magnetic fields on the properties can be deemed elevated. With a view to reducing the fields locally on each property, the possibility of using tuned, screened circuits is being investigated. Every such circuit costs an estimated 0.5 MSK. Assuming that, on average, there is one child living on each property and there are no other economic aspects to be taken into consideration, the cost per case avoided will be about 370 MSK. The cost per case will be the same if it is preferred to purchase the properties for an average of 0.5 MSK each.

Power Line Planned Through Suburban Area:
A 220 kV power transmission line is planned for a suburban area. The line will pass a multifamily dwelling within a distance at which it can be deemed to elevate the risk of childhood leukemia. There are 60 children living in the building. To avoid an elevated magnetic field, it is planned to splice a split-phase line into the section that passes the building. The additional cost entailed by this solution is estimated at 0.7 MSK. If the measure is taken, the cost per case avoided will be about 9 MSK.

CONFERENCES

1997 Conference Calendar (Part I)

Web site addresses are in italics. Part II will appear in our next issue.

January 5-9: **1st World Congress on Microwave Processing,** Hilton Hotel, Walt Disney Village, FL. Contact: Dr. William Wisecup, W/L Associates Ltd., 7519 Ridge Rd., Frederick, MD 21702, (301) 663-1915, Fax: (301) 371-8955, E-mail: <75230.1222@compuserve.com>.

January 6-9: **Progress in Electromagnetics Research Symposium 1997,** City University of Hong Kong, Kowloon, Hong Kong. Contact: Prof. K.F. Lee, Department of Electrical Engineering, University of Missouri-Columbia, 349 Engineering Bldg. West, Columbia, MO 65211, (314) 882-6387, Fax: (314) 882-0397, E-mail: <lee@ece.missouri.edu>.

January 21-22: **Workshop on Infrared Lasers and Millimeter Waves,** Brooks Air Force Base (AFB), TX. Contact: Debra Jurek, AL/OERS/SRL, PO Box 35505, Brooks AFB, TX 78235, (210) 536-3138, Fax: (210) 534-2919.

February 2-6: **1997 IEEE Power Engineering Society (PES) Winter Meeting,** New York Hilton, New York, NY. Contact: IEEE PES Executive Office, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855, (908) 562-3882, Fax: (908) 981-1769, E-mail: <soc.pe@ieee.org>, <*www.ieee.org/power*>.

February 7: **Physical Characteristics and Possible Biological Effects of Microwaves Applied in Wireless Communications,** Rockville, MD. Contact: Dr. Ewa Czerska, Center for Devices and Radiological Health, FDA (HFZ-113), 5600 Fishers Lane, Rockville, MD 20857, (301) 443-7197, Fax: (301) 594-6775, E-mail: <emc@fdadr.cdrh.fda.gov>.

February 10-14: **5th Annual Wireless Symposium & Exhibition,** Convention Center, Santa Clara, CA. Contact: *Microwaves & RF,* 611 Route 46 West, Hasbrouck Heights, NJ 07604, (201) 393-6289, Fax: (201) 393-6297.

February 18-20: **EMC Zurich '97: 12th International Zurich Symposium & Technical Exhibition on Electromagnetic Compatibility,** Swiss Federal Institute of Technology, Zurich, Switzerland. Contact: Dr. Gabriel Meyer, ETH Zentrum-IKT, CH-8092 Zurich, Switzerland, (41+1) 632-2790, Fax: (41+1) 632-1209, E-mail: <gmeyer@nari.ee.ethz.ch>, <*www.nari.ee.ethz.ch*/>.

February 20-23: **15th Annual International Symposium on Man and His Environment in Health and Disease: Special Focus on Bioelectricity (EMFs, EM Sensitivity and Subtle Energy),** Le Meridien Hotel, Dallas, TX. Contact: American Environmental Health Foundation, 8345 Walnut Hill Lane, Suite 225, Dallas, TX 75231, (214) 373-5132, Fax: (214) 361-2534, E-mail: <aehf@ixnetcom.com>.

March 2-5: **9th EPRI EMF Seminar,** Royal Sonesta Hotel, New Orleans, LA. Contact: Robert Banks Associates Inc., 2701 University Ave. SE, Suite 203, Minneapolis, MN 55414, (612) 623-4600, Fax: (612) 623-3645, E-mail: <vlprock@rsba.com>.

March 9-13: **36th Annual Meeting of the Society of Toxicology (SOT),** Convention Center, Cincinnati, OH. Contact: SOT, 1767 Business Center Dr., Suite 302, Reston, VA 20190, (703) 438-3115, Fax: (703) 438-3113, E-mail: <sothq@toxicology.org>, <*www.toxicology.org*>.

March 24-27: **1st RAPID Science Symposium: *In Vitro* Effects,** Regal Hotel, Durham, NC. Contact: Dr. Chris Portier, NIEHS, PO Box 12233, MD A3-06, Research Triangle Park, NC 27709, <*www.niehs.nih.gov/emfrapid/home.htm*>.

April 1-3: **59th Annual Meeting of the American Power Conference,** Marriott Downtown Hotel, Chicago, IL. Contact: Robert Porter, Illinois Institute of Technology, Chicago, IL 60616, (312) 567-3196, Fax: (312) 567- 3892, E-mail: <apc@iit.edu>, <*http://apc.iit.edu*>.

April 1-4: **Intermag '97: International Magnetics Conference,** Hyatt Regency Hotel, New Orleans, LA. Contact: Intermag '97, c/o Courtesy Associates, 655 15th St., NW, Suite 300, Washington, DC 20005, (202) 639-5088, Fax: (202) 347-6109, E-mail: <magnetism@mcimail.com>, <*http://yara.ecn.purdue.edu/~nyenhuis/ieeesmag.html*>.

April 2-3: **33rd Annual Meeting of the National Council on Radiation Protection and Measurements (NCRP),** Crystal City Marriott, Arlington, VA. Contact: NCRP, 7910 Woodmont Ave., Suite 800, Bethesda, MD 20814, (301) 657-2652, Fax: (301) 907-8768.

April 7-10: **Annual Convention of the National Association of Broadcasters (NAB),** Convention Center, Las Vegas, NV. Contact: Laura Cary, NAB, 1771 N St., NW, Washington, DC 20036, (202) 429-5419, Fax: (202) 429-5343, <*www.nab.org/conventions*>.

April 12-18: **5th Scientific Meeting and Exhibition of the International Society for Magnetic Resonance in Medicine (ISMRM),** Trade and Convention Center, Vancouver, BC, Canada. Contact: ISMRM, 2118 Milvia St., Suite 201, Berkeley, CA 94704, (510) 841-1899, Fax: (510) 841-2340, E-mail: <info@ismrm.org>.

April 14-17: **10th International Conference on Antennas and Propagation,** Heriot-Watt University, Edinburgh, U.K. Contact: IEE Conference Services, Savoy Pl., London WC2R OBL, U.K., (44+171) 344-5467, Fax: (44+171) 240-8830, E-mail: <lhudson@iee.org.uk>.

April 19-24: **28th Annual Meeting of the Environmental Mutagen Society (EMS),** Hyatt Regency Hotel, Minneapolis, MN. Contact: EMS, 11250 Roger Bacon Dr., Suite 8, Reston, VA 22090, (703) 437-4377, Fax: (703) 435-4390, E-mail: <emsdmg@aol.com>.

April 20-24: **1997 Electricity Conference & Exposition,** Hyatt Regency, Vancouver, BC, Canada. Contact: Canadian Electricity Association, 1 Westmount Sq., Suite 1600, Montréal, PQ H3Z 2P9, Canada, (514) 937-6181, Fax: (514) 937-6498.

April 27-May 1: **29th Annual National Conference on Radiation Control,** Sheraton Hotel, Tacoma, WA. Contact: Conference of Radiation Control Program Directors, 205 Capital Ave., Frankfort, KY 40601, (502) 227-4543, Fax: (502) 227-7862, E-mail: <cariganlin@aol.com>, <*www.webpub.com/crcpd/*>.

May 8-9: **1st World Congress on Bioelectromagnetics in Nature,** Baden Powell House, Queen's Gate, London, U.K. Contact: Roger Coghill, Coghill Research Laboratories, Lower Race, Gwent, Wales NP4 5UH, U.K., (44+149) 576-3389, Fax: (44+149) 576-9882, E-mail: <100771.1170@compuserve.com>.

May 9-16: **American Occupational Health Conference,** Convention Center, Orlando, FL. Contact: Kay Coyne, American College of Occupational and Environmental Medicine, 55 West Seegers Rd., Arlington Heights, IL 60005, (847) 228-6850, ext.152, Fax: (847) 228-1856.

May 13-14: **International Conference on Electromagnetic Energy,** Washington Vista Hotel, Washington, DC. Contact: Amy Nelson, Electromagnetic Energy Association, 1255 23rd St., NW, Suite 850, Washington, DC 20037, (202) 452-1070, Fax: (202) 833-3636, E-mail: <eea@elecenergy.com>, <*www.elecenergy.com*>.

May 13-15: **IEEE National Radar Conference (NATRAD),** Sheraton University Hotel & Conference Center, Syracuse, NY. Contact: Michael Wicks, Rome Laboratory/OCSS, 26 Electronic Pkwy., Rome, NY 13441, (315) 330-4437, Fax: (315) 330-2528, E-mail: <natrad97@rl.af.mil>.

May 21-23: **1997 International Symposium on Electromagnetic Compatibility,** Beijing, China. Contact: Ms. Fang Min, Chinese Institute of Electronics, PO Box 165, Beijing 100036, China, (86+106) 828-3463, Fax: (86+106) 828-3458, E-mail: <shaz@sun.ihep.ac.cn>.

May 23-25: **3rd Congress of the International Association of Biologically Closed Electric Circuits in Biomedicine** and **2nd International Symposium on Electrochemical Treatment of Cancers,** Beijing, China. Contact: Dr. Xinchao Bao, China–Japan Friendship Hospital, Beijing 100029, China, (86+10) 422-7535, Fax: (86+10) 421-7749, E-mail: <gzliu@hns.cjfh.ac.cn>.

June 8-13: **1997 IEEE MTT-S International Microwave Symposium,** Denver, CO. Contact: LRW Associates/Chesapeake Mailing Services, 707 E. Ordnance Rd., Suite 401, Baltimore, MD 21226, (410) 768-8757, <*www.ieee.org/mtt/mtt.html*>.

June 8-13: **2nd World Congress for Electricity and Magnetism in Biology and Medicine,** Meeting of the Bioelectromagnetics Society, the Bioelectrochemical Society, the Society for Physical Regulation in Biology and Medicine and the European Bioelectromagnetics Association, Bologna, Italy. Contact: Dr. William Wisecup, W/L Associates Ltd., 7519 Ridge Rd., Frederick, MD 21702, (301) 663-4252, Fax: (301) 371-8955, E-mail: <75230.1222@compuserve.com>.

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UPDATES

ELECTRIC BLANKETS

Low Magnetic Field Models & Induced Currents... Electric blankets with dramatically reduced magnetic fields can still induce significant electrical currents within the body of the user, according to a study by Yaofei Liu and Dr. Indira Chatterjee at the University of Nevada, Reno. In the November 1996 issue of *Health Physics (71,* pp.676-684), Liu and Chatterjee explained that low magnetic field blankets use two electrical wires running parallel to each other. Since the currents flow in opposite directions, the magnetic fields virtually cancel each other out (see *MWN,* M/J90). However, each wire also generates an electric field, which is not reduced. Concerns about possible EMF health effects generally center on the biological effects of electric currents induced in the human body—and since both magnetic and electric fields can induce currents, each must be assessed. Using a mathematical model, Liu and Chatterjee calculated that the current induced by the electric field of a low magnetic field blanket is indeed somewhat higher than that attributable to the electric field of a conventional model. Overall, with both electric and magnetic fields taken into account, the low-field blanket induces a current density about two-thirds that of a conventional blanket. "We haven't taken into account the details of the anatomy," Chatterjee emphasized in an interview. They used a simple model, composed of basic geometric forms like cylinders, lacking any limbs. They noted that a more complex model would make it possible to assess current densities in the more sensitive regions of the body and evaluate their health risks. And the geometry of the anatomy can be important: Liu and Chatterjee found that, "The average current density in the head is higher than in the torso because of the smaller cross section of the head."

MEDICAL APPLICATIONS

Treating Depression with EMFs... Studies have linked EMF exposure to depression, although these results remain controversial (see *MWN,* J/A92 and M/A94). Now it turns out that low-frequency fields can also be used to treat depression. Dr. Alvaro Pascual-Leone of the University of Valencia, Spain, and colleagues reported in *The Lancet (348,* pp.233-237, July 27, 1996) that of 17 depression patients given 10 Hz transcranial magnetic stimulation over a period of five days, 11 had improvements that lasted for two weeks. Transcranial magnetic stimulation "is practically painless, does not require anesthesia, is not coupled with the induction of a seizure and has fewer risks and cognitive side effects," the authors noted. There may be a downside, however, as Dr. P. Brown of the National Hospital for Neurology and Neurosurgery in London, U.K., pointed out in a letter in the October 5 *Lancet (348,* p.959): "[I]n studies with repetitive transcranial magnetic stimulation of the brain, the possibility of delayed malignant disease has not been considered."

OCCUPATIONAL HEALTH

Resources from EMF RAPID Program and NIOSH... Two new publications for workers concerned about EMFs were recently issued by the EMF RAPID program and by NIOSH. RAPID's *Questions and Answers: EMF in the Workplace* was written by staff members of the DOE, the NIEHS, NIOSH and Oak Ridge

National Lab. The 66-page booklet provides information on EMF basics and a reader-friendly account of the major occupational and biological studies to date. It also offers a thorough discussion of typical worker exposures and 22 pages of further sources of information: studies, research reviews and official documents. To receive a free copy of the booklet, call the EMF Infoline at (800) 363-2383; outside the U.S., call (703) 442-8934. NIOSH's four-page fact sheet, *EMFs in the Workplace,* answers some of the most common questions asked about occupational exposures. "Our pamphlet is essentially a microcosm of the longer booklet" from the RAPID program, said NIOSH's Dr. Gregory Lotz. The NIOSH document is also on the World Wide Web at:<http://www.cdc.gov/niosh/homepage.html>, or it may be ordered by calling 1-800-35-NIOSH.

POLICE RADAR

Another Lawsuit Filed... Although manufacturers of police radar guns have prevailed in well over 20 cases so far, another lawsuit was filed on October 2 in U.S. District Court in Greenbelt, MD, according to the *Gaithersburg Gazette* (October 16). The paper reported that Alan Grant, a lawyer based in Rockville, MD, had filed the suit on behalf of the family of John McKone, a Montgomery County traffic police officer who died three years ago from a metastatic melanoma that originated above his left knee. "The causation is dramatic," Grant told the *Gazette*. "That gun sitting on his knee [was in] the exact same place where the cancer started." Grant indicated that some of his witnesses would be qualified to "testify that there is a causal link." The newspaper explained that Grant would have preferred to wait longer to file the suit, but was forced to act by the state's statute of limitations. Mark Oium of O'Connor, Cohn, Dillon & Barr in San Francisco, attorney for defendant Kustom Signals, told *Microwave News* that the suit had not yet been served on Kustom. Grant did not return calls requesting comment. (For details on past lawsuits, see *MWN,* J/F96, M/A96 and J/A96.)

VISIBLE LIGHT

Frequency-Specific Bioeffects... Researchers in Switzerland and France reported in the October 26 issue of *The Lancet* on a skin rash induced exclusively by visible light. A team headed by Dr. Pierre Piletta of the Department of Dermatology at Geneva University Hospital described the case of a 52-year-old pilot who repeatedly developed a polymorphous light eruption (PLE) five to eight hours after exposure to sunlight in the cockpit. Sunscreen did not help, and clinical tests with UVA and UVB exposures did not trigger the reaction. The pilot's skin did react, however, to test exposures in the 595-625 nm range of visible light. "This is the first case of PLE specifically induced by light in the visible spectrum," according to Piletta and his colleagues. They noted that, "Visible light penetrates through the epidermis and dermis to the subcutis, where it is absorbed by hemoglobin, bilirubin and ß-carotene," and added, "Although these wavelengths carry much less energy than UVA or UVB, they still might induce biological reactions." Finally, they concluded, "The fact that different wavelengths might induce PLE supports the existence of molecules with specific absorption-spectrum characteristics capable of eliciting an immunological process."

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Cellular Phone Safety and the Marketplace

Weak Residential Magnetic Fields Affect Melatonin in Humans

EMF–Breast Cancer Link Still Unclear

Low-level electromagnetic fields (EMFs) can reduce the nocturnal release of melatonin in women, according to a new study led by Dr. Scott Davis of the Fred Hutchinson Cancer Research Center in Seattle. While the effect was small, it occurred at milligauss levels and followed a dose-response trend.

Speaking at a breast cancer workshop on November 19, Davis called the results "intriguing" given the "very low level of exposure" which reflects "real-world" conditions. The strongest effect was found among women on medication that also reduces melatonin. Davis was quick to add that the biological significance of the results is "not known at this time."

"This is the first time we are seeing evidence that relatively small changes in magnetic fields at night can be associated with decreases in melatonin levels *that night* among humans living in a normal environment," Davis told *Microwave News*.

"It's very provocative," commented Dr. David Blask of the Mary Imogene Bassett Hospital Research Institute in Cooperstown, NY, a longtime melatonin researcher. "These are some of the best data available so far linking EMFs to an important biological parameter that relates to breast cancer."

"The results offer support for one key link in the melatonin hypothesis,"

(continued on p.4)

Swiss Tests Show Wide Variation in Radiation Exposure from Cell Phones

The amount of microwave radiation absorbed by users of 16 different European digital cellular phones varies widely, according to newly released measurements. Swiss television presented these results on October 21, the first time such systematic comparisons have been made public.

The figures were published the next day by the largest newspapers in Sweden and Norway, and by a leading Swiss consumer magazine. The story was also aired on German national television on November 18.

Kassensturz, a Swiss television show on consumer issues, commissioned Dr. Niels Kuster of the Swiss Federal Institute of Technology (ETH) in Zurich to carry out the measurements. Kuster assessed the specific absorption rates (SARs) of microwave radiation from the 16 GSM phones, all with a maximum antenna input power of 0.25 W.

The phones had SARs ranging from 0.28 W/Kg to 1.33 W/Kg (see p.11). All fell within current European and international guidelines, which specify a maximum SAR of 2 W/Kg. Kuster told *Microwave News* that two phones of the same model can differ by as much as 30%.

(continued on p.10)

The Talk of San Diego: Last Rites for EMF Research

"It's like a wake," said Dr. Charles Graham when asked to describe the mood at this year's DOE EMF review in San Diego.* Dr. Antonio Sastre, who works with Graham at the Midwest Research Institute (MRI) in Kansas City, MO, used the same simile, with a little embellishment: "A wake where people are not drinking enough."

There were fewer participants, fewer papers and fewer utility staffers in San Diego for what was billed as the last DOE EMF meeting. Some researchers who were unable to find effects have moved on. Many others are disheartened by the handling of the NCI study and the NAS review, as well as the announced end of EMF work at the DOE.

Most of those who had received NIEHS research grants did not even bother showing up. Nonattendees included Drs. David McCormick of the IIT Research Institute, Jeffrey Saffer of the Battelle Pacific Northwest Labs and Jerry Williams of Johns Hopkins University, each of whom won RAPID contracts for more than $1 million.

Nevertheless, the vast majority of those who did attend the San Diego review believe EMF research should move forward. While the scientists might be discounted as motivated by self-interest, those who will have to pay the bill for future studies agreed with them—or were unwilling to say otherwise in public.

"I never believed that the RAPID program would tell us all the answers," said Leonard Hough of the municipal electric utility in Austin, TX. "The research should continue because our customers want to know if there is a health risk."

Some utilities say they will pay for more studies if their ratepayers give their blessing. "We are very responsive to the concerns of our customers and employees and will take that into consideration," said Michael Herz, the EMF program coordinator at Pacific Gas & Electric (PG&E) in San Francisco.

Citing polling data indicating that 40% of the Canadian public sees a "potential health risk from transmission lines," Dr. Kelly Gibney of BC Hydro in Burnaby, Canada, warned that, "There could be a big backlash if the public feels that this issue is being abandoned."

Clearly, the utilities are of two minds: Although they would be happy to save money, they cannot appear insensitive to public concerns. Richard Loughery of the Edison Electric Institute (EEI), whose members have contributed a large part of the RAPID funds, expressed this conflict. On the one hand, he said, "EEI is not a research organization"; on the other, "My management realizes this issue will not go away."

The funding picture is cloudy due to competition within the utility industry brought on by deregulation, said Dr. Paul Zweiacker of Texas Utilities in Dallas, the chair of EPRI's EMF advisory committee. "EPRI will have to market the EMF program to a changing industry," he said. "It will be a challenge." Zweiacker pointed out that, while EMFs were once the utilities' number one research priority, the issue is now ranked behind global warming, toxic air pollutants and ozone and particulate air pollutants.

In the midst of all the anxiety over the future, there were some intriguing new studies that brought home the potential for EMFs to do good as well as harm. As Dr. Theodore Litovitz of Catholic University of America in Washington put it: "The question is not *whether* there are weak EMF bioeffects, but rather *when* they are adverse and when they are beneficial."

Litovitz made his point with an experiment, which he described as "easy enough for a theoretical physicist to do and whose biological relevance would be obvious to a congressman." He showed that an 80 mG, 60 Hz magnetic field can have a lifesaving effect on chick embryos by prompting the synthesis of stress proteins.

MRI's Graham himself has found a highly significant effect on sleep due to intermittent exposure to a 200 mG, 60 Hz magnetic field. Exposed subjects got less sleep and a less effective night's sleep, he reported. "When they woke up, they felt they had slept poorly and felt they were much less well rested than usual," Graham said. He emphasized that sleep is intimately connected with the immune and endocrine systems.

Not even those who reported negative data want the work to stop. Dr. Rosemonde Mandeville of the University of Quebec in Laval, Canada, reported that she had found no increase in cancer among rats chronically exposed to 60 Hz magnetic fields in a multimillion dollar study. "We are making a big mistake closing down research," she said.

At last year's meeting, Mandeville reported pervasive effects of EMFs on the production of ornithine decarboxylase, an enzyme linked to tumor promotion, in her rats. "I believe there are effects at levels down to 20-40 mG that have been demonstrated and repeated," she said. Mandeville noted that within five weeks after the exposures began, the immune function of her rats was disturbed, but the rats adapted to the field. "The animals sense the stressor and adjust," she said.

Many utility representatives, including PG&E's Herz and EEI's Loughery, said that any funding decisions would have to wait until the final report of the RAPID program was completed. "I am not going to prejudge the NIEHS risk assessment," said Douglas Bannerman of the National Electrical Manufacturers Association.

The final report will not be completed for about another year. But Dr. Gary Boorman, who is responsible for the NIEHS work on the RAPID program, was willing to say that, as of now, the research should go on. "It's just getting interesting," he said.

Meanwhile, some are not waiting to see if the utilities or the government will come up with more money. Lobbying is going on behind the scenes to try and restore the DOE's EMF research program, and, at the very least, to make sure that there is enough money for another meeting next November.

Dr. William Wisecup of W/L Associates in Frederick, MD, who organizes the EMF review for the DOE and EPRI, left San Diego sounding a note of optimism. "I've been told to find a site for a meeting next year," he said.

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* *Annual Review of Research on Biological Effects of Electric and Magnetic Fields from the Generation, Delivery and Use of Electricity,* sponsored by the Department of Energy (DOE) and the Electric Power Research Institute (EPRI), San Diego, CA, November 9-13, 1997.

Multiple Sclerosis Patients Improve with PMF Therapy

Multiple sclerosis (MS) patients have reported improvements in their mental and physical performance after treatment with pulsed magnetic fields (PMFs). Energy Medicine Developments (EMD) in Vancouver, Canada, will now seek Food and Drug Administration (FDA) approval for its "Enermed" therapy and is preparing clinical trials of its efficacy.

The results of the pilot study, which was run double-blind, are "encouraging," said Dr. George Kraft, director of the MS Clinical Center at the University of Washington Medical Center in Seattle. But he cautioned people with MS not to expect PMF therapy to "in any way alter the disease course."

Writing in the *Journal of Alternative and Complementary Medicine (3,* pp.21-29, 1997), Dr. Todd Richards and coworkers report that the PMF therapy had a statistically significant effect on patient-reported physical and mental performance and on patients' brain wave activity. Richards, a radiologist at the University of Washington, has also proposed a mechanism by which PMFs may affect brain and nervous system functions.

Richards told *Microwave News* that he encountered "a lot of skepticism" when he presented his findings to neurologists at *Systems of Care in Multiple Sclerosis,* a conference held in September in Calgary, Canada. Many medical researchers consider the study "wacky," he conceded.

Patients were monitored with an electroencephalograph (EEG) while doing language tasks and while receiving retinal stimulation from a flashing light. In both tests, they had significantly stronger alpha brain waves following PMF exposures.

Richards maintained that the EEG data demonstrate that PMFs do affect brain function. He considers the EEG findings "more astounding" than the performance results.

MS is a chronic, progressive disease of the brain and central nervous system in which a hard plaque forms on the myelin sheath that covers nerve fibers in the brain and spinal cord, interfering with the transmission of nerve signals. The disease leads to speech disorders, impaired vision, cognitive difficulties, muscular weakness, spasticity and paralysis.

Richards measured the endogenous EMFs in the 1-25 Hz range in each subject's head and neck. Then, to compensate for "possible energy deficits," he applied a 50-100 mG field with a pulse width of 1 msec and pulse repetition rates at 4-13 Hz.

Richards noted that prior studies showed that MS patients have low electrical potentials at certain brain frequencies. These deficits, he believes, may reduce the brain's efficiency and disrupt the timing of signals to other parts of the brain and to the rest of the body.

Patients wore a wristwatch-size PMF device on an acupuncture point on the shoulder, back or hip for two months. On the first day, exposures lasted four hours; they increased by one hour on each following day until the units were on continuously.

Richards became interested in the possibility of treating MS patients with PMFs when EMD treated him for migraine with pulsed fields—an application approved for use in Europe and Canada since the 1980s.

In the pilot study, 15 subjects were given an active device and 15 were given an otherwise identical device in which the magnetic coil was disconnected. Neither the patient nor the physician knew whether a device was active.

Nine of the 15 patients with an active coil reported "major" improvements in their performance, while four reported virtually no change and two reported slight deterioration. As a whole, this group had significant improvements in cognitive function, mobility and vision, as well as reduced fatigue and spasticity.

In the placebo group, three patients reported significant improvements and two reported minimal improvements. Four patients in the placebo group reported no change and six reported a worsening of their symptoms.

Some patients in the active group experienced increased headaches in the first week of treatment, and some placebo patients reported more depression.

Double-blind, clinical trials of the Enermed therapy will begin in early 1998 and will involve approximately 140 patients at three sites, Dr. Martha Lappin, EMD's research director, told *Microwave News*. Results should be available by the fall of 1998.

The Enermed therapy for MS has been in use in Canada since 1995, and approximately 120 patients have been treated there, according to EMD's president, Fraser Lawrie.

EPRI Meta-Analysis Finds Worker EMF–Leukemia Risk

A meta-analysis by the Electric Power Research Institute (EPRI) of 38 epidemiological studies has found "a small but significant elevation in risk of leukemia in relation to... workplace magnetic field exposure." But the EPRI team concludes that the lack of a clear dose-response relationship "substantially detracts from the hypothesis" that EMFs are responsible for the increase.

Dr. Leeka Kheifets, who heads EPRI's EMF health research group in Palo Alto, CA, found a statistically significant 18% increase in risk for workers in electrical occupations.

In the November *Journal of Occupational and Environmental Medicine (39,* pp.1074-1091), Kheifets and four coworkers write that biases internal to each study did not appear responsible for the observed increases in risk. Studies that controlled for many potential confounders showed higher odds ratios for leukemia, they report. On the other hand, "studies with complete work history or measurements of EMF exposure did not produce higher estimates."

To see if there was selective publication of positive results, Kheifets did a second analysis of overall risk, which included unpublished data. The increase in risk was reduced to 10%, but was still significant. The paper cites this as "some evidence of publication bias."

This meta-analysis is similar to one on brain tumors and occupational EMF exposure—conducted by essentially the same group—which found a significant 10-20% increase in risk (see *MWN,* J/F96). The new paper comments: "The 38 leukemia studies in this meta-analysis showed considerably less heterogeneity than the 29 studies of brain cancer."

Drs. Patricia Buffler of the University of California, Berkeley, and Abdelmonem Afifi of the University of California, Los Angeles, also served on the study team.

said Dr. Richard Stevens, who is collaborating with Davis on both the melatonin study and a major epidemiological study of a possible association between breast cancer and exposure to EMFs and/or light-at-night.

First proposed ten years ago by Stevens, the melatonin hypothesis posits that the rise in the use of electric power is partially responsible for increases in breast cancer in Western societies (see *MWN,* J/F87). Stevens is with the Battelle Pacific Northwest Labs in Richland, WA. Dr. William Kaune of EM Factors, also in Richland, is responsible for assessing exposures in both studies.

A Hint of Risk for Some Young Women

At the same November workshop,* Dr. Maria Feychting of the Karolinska Institute in Stockholm, Sweden, reported that women under the age of 50 exposed to 2 mG or more had an 80% greater incidence of breast cancer than did those exposed to less than 1 mG. This result, based on only 15 cases and nine controls, was not significant, according to Feychting. She saw no increased risk among women over 50, or women of all ages combined, who were exposed to 2 mG or more.

When Feychting limited the analysis to women under 50 whose breast cancer was estrogen-receptor-positive (ER+), the relative risk of developing breast cancer jumped to 7.4 among those exposed to 1 mG or more. This result was of borderline significance but included only six cases and one control.

"There is an indication of an increased risk in younger women, especially for ER+ breast cancer," Feychting said, "but the small numbers make this result unreliable and it may be explained by random error."

In an interview with *Microwave News,* Feychting called her results for premenopausal women with ER+ breast cancer "inconclusive": "Our study cannot stand on its own. We need other studies to confirm or refute our results."

Feychting identified 699 cases of breast cancer among those living in single-family homes within 300 meters of high-voltage power lines in Sweden. The cases came from the same population that she and Dr. Anders Ahlbom used in their landmark childhood leukemia study (see *MWN,* S/O92). There were only nine cases of male breast cancer—"too few to allow a conclusion," according to Feychting.

Feychting will publish the results next year in *Epidemiology.* Ahlbom also collaborated on the breast cancer study.

Dr. Nancy Wertheimer noted that the pattern of risk observed by Feychting is the same as she saw in her own study of adults living near high-current power lines. In a 1987 paper, Wertheimer and Ed Leeper reported a statistically significant increased risk of breast cancer among women under the age of 55. "Feychting's study strengthens the idea that there may be an association, but it may be limited to certain types of breast cancer," she said in an interview.

The results of Davis's breast cancer epidemiological study—sponsored by the National Cancer Institute (NCI)—were not ready for release at the workshop. "We hope to have some interesting results in three or four months," Davis said. He noted that the melatonin findings are "clearly relevant" to the breast cancer study.

The melatonin study was supported by the Electric Power Research Institute (EPRI) in Palo Alto, CA. It is an "excellent study," EPRI's Dr. Kristie Ebi told *Microwave News.* Ebi said that Davis's report to EPRI should be available in December.

Davis investigated the influence of magnetic fields and light-at-night, as measured in the bedroom, on the nocturnal secretion of 6-sulphatoxymelatonin in the urine of 200 healthy women over three consecutive nights. The women, whose ages ranged from 20 to 79, with the majority between 40 and 74, were selected from the larger control population of the breast cancer epidemiological study.

A number of factors are known to alter melatonin production in humans: age, alcohol consumption, body weight, darkness-at-night and a variety of drugs, including beta-blockers, calcium channel-blockers and psychotropics. Each of these variables was taken into account in assessing EMF effects.

EMF Effect on Melatonin Strongest with Drugs

Davis found statistically significant decreases in the concentration of 6-sulphatoxymelatonin among women who were exposed to magnetic fields *and* who took melatonin-lowering drugs. A doubling of nighttime magnetic field exposures led to an 8% decrease in urinary 6-sulphatoxymelatonin. Tripling and quadrupling the magnetic field exposures resulted in 12% and 15% decreases in 6-sulphatoxymelatonin, respectively. The magnetic field effect was also observed among subgroups that would be expected to have lower melatonin due to other factors.

"There was a weaker effect of magnetic fields on 6-sulphatoxymelatonin among women not on drugs, but it was not significant," said Stevens. "The data did not allow us to reach a conclusion on the nature of a dose-response relationship for this group of women," he added.

EMFs, Light-at-Night: "Potential" Risk Factors for Breast Cancer

"According to an international panel, electromagnetic fields and environmental light may be considered potential risk factors for breast cancer, based on existing scientific evidence," declared a press statement issued by ten speakers at the EMF and light-at-night workshop, organized by the Etiology Working Group of the National Action Plan on Breast Cancer.

The statement was signed by: Dr. David Blask, Bassett Research Institute, Cooperstown, NY; Dr. George Brainard, Jefferson Medical College, Philadelphia; Nancy Evans, Breast Cancer Fund, San Francisco; Dr. Charles Graham, Midwest Research Institute, Kansas City, MO; Dr. Cristina Leske, State University of New York, Stony Brook; Dr. Robert Liburdy, Lawrence Berkeley National Laboratory, Berkeley, CA; Dr. Wolfgang Löscher, School of Veterinary Medicine, Hannover, Germany; Dr. John Reif, Colorado State University, Fort Collins; Cindy Sage, Sage Associates, Santa Barbara, CA; and Dr. Louis Slesin, *Microwave News,* New York City.

* *A Workshop on Electromagnetic Fields, Light-at-Night and Human Breast Cancer,* sponsored by the National Action Plan on Breast Cancer, Washington, DC, November 18-19, 1997.

"New England Journal of Medicine" Publishes Responses to the NCI's EMF Study and Campion's Editorial

In its November 13, 1997 issue, the New England Journal of Medicine *published seven letters responding to the National Cancer Institute's (NCI) study of EMFs and acute lymphoblastic leukemia (ALL) in children by Dr. Martha Linet and coworkers (see* MWN, *J/A97), along with replies from the researchers and from Dr. Edward Campion, who wrote the accompanying editorial, "Power Lines, Cancer and Fear." Below are excerpts from the exchange, as well as from "Controversial* Journal *Editorials," which appeared in the same issue.*

Even when the negative results obtained with the use of wire codes to categorize exposure are included in the meta-analysis I originally conducted for the National Academy of Sciences, the combined result is still positive and statistically significant.

—Dr. Daniel Wartenberg, Environmental and Occupational Health Sciences Institute, Piscataway, NJ

It is unclear why the authors highlighted the results of the unmatched analysis [odds ratio=1.24] in the abstract when the results of the matched analysis [odds ratio=1.53] were appropriate.

—Dr. Richard Stevens, Pacific Northwest National Laboratory, Richland, WA

...a statistically significant association was observed for levels ≥0.3 ∝T....Very few people are usually exposed to residential magnetic-field levels ≥0.3 ∝T. However, this level might be regularly exceeded among people living close to high-voltage power lines.

—Dr. Patrick Levallois and Denis Gauvin, Centre de Santé Publique de Québec, Beauport, PQ, Canada

...an odds ratio of 1.24 can hardly be considered a negative result, as Campion and the press reported. One must remember that the true odds ratio is just as likely to be 1.79 as it is to be 0.86....many persons would take seriously a 20% increase in their own risk of leukemia....far from laying the issue to rest...recent studies point to the need for additional high-quality studies.

—Dr. Michael Gochfeld, University of Medicine and Dentistry of New Jersey, Piscataway, NJ

...it appears that there is a statistically elevated odds ratio at the level of 0.400 to 0.499 ∝T: 3.28 in the unmatched analysis and 6.41 in the matched analysis. I looked for an explanation in the text, but there is none.

—Harold Funk, Communications, Energy and Paperworkers Union of Canada, Local 226, Vancouver, BC, Canada

The real qualitative advance of the study by Linet et al. was to obtain measurements within two years of the diagnosis. Perhaps this is why they came almost as close as the Swedish researchers in showing a direct effect of measurements of EMFs.

—Dr. Raymond Richard Neutra, California Department of Health Services, Berkeley, CA

Far from having been wasted, the money spent on this research has yielded important information regarding the apparent lack of a strong association between [EMFs] and childhood leukemia. This information should both help allay the fear and galvanize researchers to pursue new hypotheses.

—Dr. Geoffrey Kabat, University Medical Center, Stony Brook, NY

We did not "summarily dismiss" [the significant odds ratio of 1.72 at exposure levels of 0.3 ∝T or greater] but mentioned it three times in the discussion section and noted the possibility of an increased risk at such high levels. We tended to discount the increase in our interpretation because of the post hoc nature of the analysis, the inconsistent dose-response pattern (a markedly increased risk at a level of 0.400 to 0.499 ∝T but no increased risk at a level of 0.5 ∝T or higher), the absence of a significant trend and the small number of exposed children.

—Drs. Martha Linet and Robert Tarone, NCI, Bethesda, MD, and Dr. Leslie Robison, Children's Cancer Group, Arcadia, CA

Years ago, on the basis of inadequate data, a premature conclusion that residential exposure to [EMFs] was hazardous and caused ALL was widely publicized. That belief produced the pressures that made the larger studies necessary. We now find that there is little evidence to support such a conclusion, so we really have not learned anything at all about leukemia. It is unfortunate, even irrational, if large amounts of research dollars are spent because of fear and suspicion....

—Dr. Edward Campion, deputy editor, *New England Journal of Medicine*

In the *New England Journal of Medicine,* editorials are always signed by individual authors, and they represent the opinions of the authors alone, not those of the *Journal* itself...[W]e believe that publishing opposing articles on every controversial issue discussed in the pages of the *Journal* would not only be unwise but also tedious....We cannot afford to be too concerned about whether some people or groups will be offended.

—Dr. Jerome Kassirer, editor in chief, and Dr. Marcia Angell, executive editor, *New England Journal of Medicine,* in "Controversial *Journal* Editorials"

Davis said that he was encouraged by the internal consistency of his results—that is, melatonin levels were lower among those whose age and alcohol and drug use would be expected to reduce melatonin. "It gives us some assurance that the magnetic field effects are real," he said.

"I think Davis's results are fascinating, and they suggest that we should look more closely at individual melatonin patterns in humans," said Dr. Charles Graham of the Midwest Research Institute (MRI) in Kansas City, MO. In his talk at the breast cancer workshop, Graham pointed to a "strange paradox": researchers see an EMF–melatonin effect in the real world but not in controlled laboratory exposures (see *MWN,* M/A97).

How important are EMFs in the melatonin equation? Dr. Daniel Kripke of the University of California, San Diego, who also spoke at the workshop, argued that "any effects of light-at-night or EMFs on melatonin would be dwarfed by the drugs in the older age groups, where the incidence of breast cancer is highest."

Davis agreed that his study shows certain drugs have a greater impact on 6-sulphatoxymelatonin than any other factor. But, he added, "I think it is remarkable that even after accounting for the effect of the drugs, we still see a magnetic field effect."

« Wireless Notes »

The British cellular phone industry is facing trouble on two fronts. MOBILE PHONES GAVE US CANCER read the headline of a story in *The Express,* a major U.K. tabloid, on September 28. The article profiled financial trader Giovanni de Dominicis and demolition worker Terry Clark, both of whom have developed Hodgkin's disease, a type of lymphoma. Clark, 23, and de Dominicis, 25, blame the disease on their frequent use of cellular phones. "Both me and Giovanni got the lumps just next to our right ears where we held the phones," Clark told *The Express*. In a separate article, *The Express* reported that a number of engineers at **British Telecom** (BT) blame their cellular phones for serious health problems. One BT engineer told the paper that he had been unable to work for the past two years, and that his memory is so impaired that he sometimes forgets his daughters' names. While his coworkers were too frightened to speak out, he said, he wanted to talk—at least anonymously—because "I've got nothing left to lose." Dr. **John Rao**, who has been treating the engineer, told *The Express,* "The only possible explanation is his frequent exposure to the radiowaves from mobile phones." Rao is a psychologist at Luton and Dunstable Hospital in Luton, north of London. The articles came in the wake of British media attention to studies on microwave exposure and memory loss (see *MWN,* S/O97), and appear to be the first press reports in the U.K. to link cellular phones to health problems of specific individuals. In a September 30 follow-up article, MENACE OF THE MOBILE, *The Express* stated that health effects of microwave exposure "could have something to do with the pulsing nature of the microwave radiation...emitted by the new digital phones." Many BT engineers have refused to carry or turn on the digital GSM mobile phones which they'd been assigned, according to **Alasdair Philips**, an EMF consultant based in Sutton, Cambridgeshire. He told *Microwave News* that workers say that the company responded by allowing engineers to use older analog models instead (see also p.14). Philips has received over 50 calls from BT employees about health problems and mobile phones. Besides memory impairment, the complaints include anxiety attacks and persistent headaches. "We have had some complaints, and obviously we are looking into them," BT senior press officer **John Moggeridge** said in an interview, but he added that the number of such complaints has not increased. "We take any issue that allegedly affects the health of our people very seriously," he declared, "and as a company we are committed to closely following the research." Moggeridge noted that the U.K.'s **National Radiological Protection Board** (NRPB) maintains that there is "no firm evidence" linking mobile phone use to any health problems. Moggeridge said that while some local supervisors may have allowed the use of analog phones, this did not reflect any national company policy. Philips has now begun a survey on mobile phone health effects. He explained that the issue has been little studied in the U.K., and commented that, "Many users are suffering in silence, or, if they visit their doctor, they are sent to the psychiatric services." The survey is being conducted jointly with a consultant to the National Health Service and with the personal injury law firm of **Leigh Day & Co.** in London, which has been in the forefront of EMF litigation in the U.K. (see *MWN,* S/O97).

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Meanwhile, Dr. **John Stather**, deputy director of the **NRPB**, now says that the idea of nonthermal microwave bioeffects must be taken seriously. In the past, the NRPB and other advisory panels held that the only possible harmful effects from microwaves would be those due to heating. But in November, Stather told *Microwave News* that, "A number of studies have been published reporting effects that were not necessarily simply the result of thermal heating." He specifically cited recent work by Dr. **Henry Lai** of the University of Washington, Seattle, which indicated that microwave exposure could interfere with the learning abilities of rats. "In the specific case of possible effects on behavior," Stather cautioned, "the studies that have been reported are not representative of human exposure conditions arising from the use of mobile phones and, therefore, effects on memory and other brain functions in people using mobile phones, under normal conditions of use, are not expected." But he added that the NRPB believes more research is needed in this area, including replication of reported nonthermal effects. Stather noted that the NRPB supports the proposed **European Commission** research project on cellular phone health effects, which is still awaiting funding (see *MWN,* M/A97 and J/A97).

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On its cover last February, ***Consumer Reports*** posed the question, CELL PHONES: DO YOU REALLY NEED ONE? It promised to tell readers "how to decide"—but made no mention of possible health effects (see *MWN,* M/A97). Now the magazine has broken its silence: A November article comparing different models of cellular phones includes a sidebar titled THE HEALTH ISSUES. *Consumer Reports* notes that "scary news stories in 1993" raised the cancer question, but also points out that there have been few studies specific to cellular phones. The magazine reports that "a few studies suggest that there may be an association between exposure to RF energy and some kinds of cancer," but concludes that "there is no convincing evidence to date of any causal connection." Those who want to be cautious anyway, it suggests, can use a plug-in headset, which puts distance between the user and the phone's antenna. The brief sidebar also deals with driver safety and interference with cardiac pacemakers.

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The **Swedish Work Environmental Fund** is sponsoring a new epidemiological study on cellular phone radiation and brain tumors. Dr. **Lennart Hardell** of the Örebro Medical Center is working with a team of researchers that includes Dr. **Kjell Hansson Mild** of the National Institute for Working Life in Umeå. They will survey approximately 600 brain tumor patients and 600 controls on their history of cellular phone use. The cases will be drawn from among the 1,500 people expected to be diagnosed with brain tumors in central Sweden in 1997-98. "Only living cases with histopathologically confirmed brain tumors will be included," Hardell told *Microwave News,* explaining that this will increase the study's accuracy. Exposures will be assessed by questionnaires and, if necessary, supplemented by phone interviews.

Three other studies are already under way—all initiated after David Reynard charged in 1992 that his wife's fatal brain tumor was caused by her cellular phone. At a congressional briefing in February 1993, the **National Cancer Institute** (NCI) announced plans for a five-year study of brain tumors that would examine the cellular phone link (see *MWN,* J/F93). The NCI's Dr. **Martha Linet** said data collection should be completed by September 1998, but that results will not be published before late 1999. Meanwhile, the **American Health Foundation** (AHF) is in the midst of a study similar to the one in Sweden, involving 500 brain tumor cases and 500 controls. The AHF effort, funded by WTR, should be completed in about six months (see p.8 and *MWN,* J/A96). In another WTR study, **Epidemiology Resources Inc.** (ERI) announced some "preliminary findings" last year, indicating that hand-held phones were not linked to an increase in overall mortality among 256,000 cellular phone customers. At the time, however, ERI said that it could not draw firm conclusions because it had not examined cause of death. This October —after a delay of over a year and a half due to funding difficulties —ERI began the study's second phase, in which it will analyze both mortality and cause of death among more than a half-million hand-held and car phone users (see below and *MWN,* M/J96). ERI plans to publish results by next fall.

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Rep. **Edward Markey** (D-MA) is again asking questions about cellular phone safety. In a November 21 letter, Markey requested that the **FDA** report on its "ongoing oversight of this issue," reiterating his view that "it is incumbent upon the government" to ensure that there is enough research to assess potential health risks. The letter lists a number of detailed questions, including one as to whether the FDA agrees with the Harvard Peer Review Board that the industry-funded research group, **WTR**, should release the audits of its spending (see p.9). Last April, in response to an inquiry from Markey, the FDA said that research proposed by WTR "should provide part of the answer" to the safety question. At that time, a Markey aide told *Microwave News* that the congressman was unwilling to commit federal funds to the effort (see *MWN,* M/J97). Markey, the ranking Democrat on the House telecommunications subcommittee, requested that the FDA respond to his latest questions by December 19.

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Mohamed Al Fayed, owner of the British department store Harrods, is contesting a decision to permit a mobile phone tower near his estate in Oxted, Surrey, outside of London. On December 1, a judge allowed Al Fayed to challenge a local planning board ruling on the 70-foot tower, but rejected a request to halt construction while the case is pending. Al Fayed's solicitor, Alan Meyer of Halsey Meyer Higgins in London, views the case as an opportunity to air concerns about the potential health risks of cellular antennas, according to the December 2 *Daily Telegraph*. The *Telegraph* reported that Al Fayed is himself a wireless phone user, but that, Meyer said, he "believes in helping his community." Al Fayed's son, **Dodi**, was courting **Princess Diana** before they both died in a car accident in Paris last summer.

Victories for Industry in Cellular Phone Litigation

In November, the U.S. cellular phone industry prevailed in one lawsuit and won a partial victory in another. Plaintiffs withdrew the *Rittmann* brain tumor lawsuit in Texas. In Illinois, four of five counts were dismissed in the *Busse* suit, which charged industry with illegally using consumers as research subjects.

"These developments...should further dispel the cloud some have tried to cast over the safety of cellular telephones," said Norman Sandler of Motorola, a company which was a defendant in both cases. Sandler declared that there is "a sound, scientific basis for confidence in the safety of wireless technologies."

The *Rittmann* suit was filed in August 1995 by the family of Dean Vincent Rittmann Jr., a physician who died of a brain tumor in 1994 (see *MWN,* M/J96). Besides Motorola, defendants included Ericsson and service provider Cellular One. Attorneys for both companies did not respond to requests for comment, and the Rittmann family's lawyers at O'Quinn & Laminack in Houston also did not return repeated phone calls. John O'Quinn is one of the most prominent attorneys representing plaintiffs in litigation over the safety of breast implants.

According to Sandler, 12 cellular phone actions have now been rejected or withdrawn in the U.S. The only cases still known to be active are *Busse* and the brain cancer suit filed by former Motorola engineer Robert Kane (see *MWN,* J/F94 and S/O97).

Filed in October 1995 in Cook County Circuit Court, the *Busse* suit accused the wireless industry of conducting illegal human testing on cellular phone health effects (see *MWN,* J/F96 and M/J97). Lawyers cited an epidemiological study that Epidemiology Resources Inc. (ERI) in Newton Lower Falls, MA, is conducting for WTR, the industry's research group, and the fact that the phones were marketed without any health warnings.

In November, Judge Ellis Reid dismissed the charge that lead plaintiff Jerald Busse and others were exposed to potentially harmful microwave radiation from their cellular phones. The judge also dismissed three related claims, but allowed the one count that Busse's attorneys say is central to their case.

"The court upheld the invasion-of-privacy count," attorney Ben Barnow of Barnow & Goldberg in Chicago, told *Microwave News*. "This vindicates the position of the plaintiffs," Barnow asserted. "Every defendant was kept in—CTIA, ERI, WTR, Ameritech and Motorola." Busse is challenging the use of telephone billing records and medical information in the ERI study.

"The question of invasion of privacy is the key issue underlying everything," Dr. Nancy Dreyer, president of ERI, said in an interview. "They're challenging the idea that industry should be able to study the safety of its products." Dreyer argued that such studies are standard in the pharmaceutical industry.

The cost of ERI's defense "is into six figures," said Dreyer, "and none of it's being borne by the industry. WTR is picking up zero." She added that, "If I wasn't already this far down the line, I'd have to seriously consider whether to take on this research without any protections." In her 18 years of research, Dreyer stated, "This is the only instance where the sponsor has taken such a hands-off position." WTR would not comment.

Cell Phone Industry's Research Group Lowers Its Sights: WTR Drops Plans for Chronic Exposure Animal Studies

The wireless industry's research group has announced that it will not carry out any long-term animal studies. "The funding level currently committed by the industry...will not allow for extensive subchronic nor whole-life animal studies," Wireless Technology Research (WTR) declared on November 3.

The announcement represents a major retreat from WTR's previously announced goals. Its 1994 research agenda called for a series of chronic studies with rodents, in which the animals would be exposed over their entire life span of about two years. A WTR report in 1995 predicted that these long-term studies would be completed by the end of 1997 (see *MWN,* S/O95). WTR later committed itself to additional, subchronic experiments, which would expose the animals over a 90-day period.

"Given the lack of funds available to WTR to finish this work," the statement continued, "it is up to the government and the industry to work out how they wish to resolve this issue."

WTR is funded by the Cellular Telecommunications Industry Association (CTIA), which in 1993 pledged that the industry would contribute $25 million for health research. Last spring, "the CTIA told us that the last set of payments we would provide was going to be used for these lifetime rat studies," said John Madrid, Toshiba's representative to the CTIA committee on research funding (see p.14).

WTR's decision runs counter to recent advice from the Food and Drug Administration (FDA). In a March letter to WTR chair Dr. George Carlo, the FDA's Dr. Elizabeth Jacobson urged that lifetime animal studies "should be given highest priority" with WTR's remaining funds. But WTR now says that Carlo believes animal studies are of limited value.

"We're not in a position to tell WTR what to do," Dr. Mary Beth Jacobs of the FDA's Center for Devices and Radiological Health (CDRH) told *Microwave News* from her office in Rockville, MD. In fact, WTR is following very little of the FDA's advice. The FDA's March letter also called on WTR to study the interaction of cellular phone radiation with chemical carcinogens, and to look at other possible health problems besides brain cancer, such as eye damage (see *MWN,* M/A97). Neither of these issues is addressed in WTR's plans for its last two years of work.

Susan O'Donnell, WTR's public affairs manager, declined to elaborate on the press statement, and said that Carlo is not doing any interviews. "He wants to focus on the work that needs to be done, rather than on talking to the media," she explained.

WTR still plans to complete two epidemiological studies, as well as carry out some *in vitro* genotoxicity work and a follow-up to the Lai-Singh experiments, in which rats were exposed to microwaves for just a few hours.

WTR's Peer Review Board (PRB) has asked WTR to revise its 1994 research agenda and make no further commitments of research funds until the revision is completed. The PRB, based at Harvard University's Center for Risk Analysis in Boston, explained in a July 15, 1997 letter that this was needed "to enhance the scientific integrity of WTR," and predicted that a revised agenda could be drafted in a matter of weeks.

While the Harvard letter did not specify what kind of changes the PRB wants to see, it did urge that WTR increase its support for epidemiological studies (see also p.6). The PRB particularly

George Carlo's Many Projects: From Dioxin to Breast Implants

Dr. George Carlo's role as head of WTR will end in 1999. But Carlo will not be out of a job, for WTR is just one of his many projects. Carlo's consulting firm, Health and Environmental Sciences Group Ltd. (HES), has also been working on breast implants, air pollution and tobacco.

Before WTR, HES was perhaps best known for its work on the dioxin issue. The Chlorine Institute hired Carlo as a $150-an-hour consultant as part of its effort to relax federal restrictions on the chemical. Carlo prepared a report which contended that an industry-sponsored scientific conference had reached a consensus that dioxin causes no damage below a certain "threshold" level. But there was no such consensus, as the Chlorine Institute later had to admit. The *Wall Street Journal* (February 20, 1992) described Carlo's attempt to control the message as part of "a well-financed public-relations campaign."

Carlo shares the decision-making at WTR with Dr. Ian Munro, head of the Canadian toxicology consulting firm CanTox in Mississauga. As reported in *Science* magazine (July 9, 1993), CanTox has also been employed by the Chlorine Institute, producing reports which argue that the dangers of chlorine compounds have been exaggerated.

Today the wireless industry is not Carlo's only patron: He is also director of the "Breast Implant Public Health Project" (BIPHP), which shares the same phone number with HES and WTR. Founded last year, the BIPHP has received $1.3 million from Dow Corning Corp. of Midland, MI. The BIPHP is dealing with problems like scar tissue and causes of implant rupture, and the project states that "at this time" it will not address the controversy over the risk of systemic disease.

HES is also working on airborne particulates and ozone, both subjects of intense industry lobbying. An Environmental Protection Agency proposal for stricter standards "is not only inconsistent with scientific and medical data, but runs contrary to the tenets of public health protection," according to a paper that HES will present at the *Annual Meeting of the Society for Risk Analysis* December 10 in Washington. "Nobody's given us any money for this," said HES' Susan O'Donnell. She explained that the paper was prepared in response to interest from a Washington consultant.

Last summer, HES provided staff for an advisory committee, cochaired by former Surgeon General Everett Koop and former FDA Commissioner David Kessler, that reviewed a proposed settlement of lawsuits against tobacco companies.

Carlo also teaches at "The Carlo Institute." Among the topics covered in a recent six-session, $650 course were "Media Relations" and "Effective Management of Research Funds."

How Has WTR Spent the CTIA's Research Money?

When WTR's funding runs out, much of the work proposed in its 1994 research agenda will remain undone. WTR has argued that it was simply not possible to move any faster. Indeed, WTR chair Dr. George Carlo recently said on Canadian television that, "We are moving at the speed of light" (see p.14).

A different point of view was expressed by John Madrid, Toshiba's representative to the CTIA committee that deals with research funding: "The bottom line is, a lot of money was collected and not very much research got done." In the future, Madrid said, "I wouldn't give the CTIA or WTR a plugged nickel. I don't think either of those organizations has properly managed the money given to them for health research. I don't know what they've done with more than $20 million."

WTR's Peer Review Board (PRB), based at the Harvard Center for Risk Analysis, has urged Carlo to reveal details about WTR's finances. In a July 15 letter, the PRB specifically asked WTR to release its audited financial statements. But WTR rejected the idea.

In its November 3 press statement, WTR declared that, "All required [financial] procedures have been followed by both WTR and the industry, and both parties remain satisfied." It explained that:

> The large amount of work done by WTR in preparation for *in vitro* and *in vivo* experiments was [necessary]....New systems were invented and existing systems were modified based on tedious scientific study....Cash flow problems resulting from the dispute with CTIA about legal expenses slowed some work, but the essence of the WTR program has remained intact throughout.

According to the CTIA's Tim Ayers, an audit of WTR is done annually by Deloitte & Touche, and copies are provided to WTR and to the CTIA's CEO Council. Ayers argued that there was no need for anyone else to see it: "It's been delivered to the people who pay the bucks, and they're satisfied."

But Madrid said that the audit may not have addressed the main issues—"where was the money spent, what kind of research did they do and how much did it cost? I'm satisfied that they probably did the accounting, but that's meaningless if WTR didn't get the job done. And the CTIA has to share the blame for that."

WTR has consistently declined to provide the financial details of its outside research contracts. *Microwave News* asked for this list in May 1996 and again this November, as did the PRB in July. WTR has refused every time. "If they do eventually account for it all," said Madrid, "I think you'll find that several million dollars were spent on research," he said. "But what happened to the rest of it?"

The other unanswered question is what will happen to the unfinished portion of the WTR research agenda. When the agenda was released in 1994, then-CTIA vice president Ron Nessen commented, "It's probably going to take more than $25 million. The industry has said that it will spend whatever it takes" (see *MWN,* S/O94). But this November, CTIA spokesperson Tim Ayers would say only, "Our commitment is to provide the remainder of the $25 million." Ayers told *Microwave News* that any decision on further funding of health research "will be reviewed at a future time—whether or not we do it, as well as in what way to do it."

Postponing that decision worries the PRB. Its July letter declared that, "The PRB is concerned that industry has not come forward with a plan to support a continued program of health research" after WTR's funding ends.

Dr. John Graham, head of the Harvard Center for Risk Analysis, would not reveal how much money the center has received from WTR for the work of the PRB. The center's Dr. Susan Putnam told *Microwave News* that Graham and Harvard University feel that, "It's not a government grant, and they see no reason why it should be publicized."

objected to WTR's decision "not to fund several highly rated epidemiologic case-control studies of phone users." Five of the PRB's 12 members are epidemiologists, while a sixth—Dr. Gary Williams of the American Health Foundation in New York City—works for an organization that is conducting a half-million dollar epidemiology project for WTR. (Carlo is an epidemiologist as well.)

No contracts have yet been signed for any short-term WTR animal studies. Drs. Henry Lai and N.P. Singh of the University of Washington, Seattle, met with WTR representatives on November 24 at the City of Hope National Medical Center in Duarte, CA, to discuss replication of their experiments showing increases in DNA breaks in the brains of rats after two hours of exposure to microwave radiation (see *MWN,* N/D94, N/D95 and M/J96).

When WTR's research agenda was unveiled in 1994, Carlo said that genotoxicity studies would be under way "with checks signed" by the end of that year.

In vitro work is finally about to begin, at Integrated Laboratory Systems (ILS) in Research Triangle Park, NC. ILS' Dr. Ray Tice said that after fine-tuning the exposure system, researchers are scheduled to do dry runs in November, with the first experiments following in December.

WTR is also considering a set of short-term studies with transgenic mice—animals genetically altered to be prone to cancer. In theory, this susceptibility makes it possible to obtain useful results in less time. But, in some cases, the incidence of cancer among controls can vary widely, which makes it difficult or impossible to detect weak effects (see also *MWN,* M/A97).

These and other issues on the use of transgenic animals will be discussed at a WTR scientific workshop in early 1998, at which "the fate of transgenic mouse studies...will be decided," WTR stated on November 3. "We are very supportive of the workshop," Dr. Russell Owen, chief of the CDRH's Radiation Biology Branch, told *Microwave News*.

"WTR projects that the results of more than 30 WTR-sponsored *in vitro, in vivo* and epidemiology studies will be released between February 1, 1998, and June 30, 1999," the November 3 statement declared. When asked for a list of the 30 studies, WTR refused to provide one, but revised the number downward to about 25.

Some models have high SARs because their designs place the antenna close to the user's head. According to Kuster, this was true of the Philips and Ascom models. Phones with shorter antennas also tend to have higher SARs, since this concentrates the radiation in a smaller area.

Motorola's tiny StarTac, with an antenna directed away from the head, had the second-lowest SAR. The phone with the lowest SAR of all is made by a little-known German manufacturer, Hagenuk. The antenna of the Hagenuk GlobalHandy is built into the handset, and is shielded to minimize the amount of radiation directed towards the user's head (see *MWN,* S/O97).

"We are satisfied that the reported test results confirmed what consumers deserve to know," said Norman Sandler, Motorola's director of global strategic issues. "All of the phones in question meet recognized safety standards that are accepted around the world as adequate safeguards of public health."

The Swedish Mobile Telecommunications Association, known by the Swedish acronym MTL, emphasized that, "There is...no evidence today that normal use of mobile phones presents any risk to public health." The MTL added that while cellular phones connect with a base station at maximum power, they are then turned down to the lowest power needed for a clear signal.

"For particularly sensitive people," the MTL conceded, "it is known that some discomfort may occur. A mobile phone can then be equipped with a portable 'hands-free' device, with an earpiece and a microphone," so that the phone and its antenna can be placed farther from the user. "In many cases this helps," stated the MTL. "If problems persist, a doctor should be contacted."

Bo Albertsson, spokesperson for Ericsson, a major cellular phone maufacturer, told *Aftonbladet* that Ericsson has no plans to develop lower-radiation phones. "But if consumers see this as an important issue," he added, "then we would have to begin to think about this differently."

"Most manufacturers don't give priority to reducing radiation exposure," wrote *Aftonbladet*'s Christofer Fager. "They go in for design—for example, to make the phone as thin as possible." The Swiss consumer magazine *K-Tip* pointed out that the phone with the highest SARs, made by Ascom, comes from a company that has won design awards—but owns no radiation-testing equipment. Kuster told *Microwave News* that manufacturers see the antennas as "an annoying accessory." They are purchased from subcontractors for no more than a dollar each, he said.

The Olé antenna, a Swedish design in which the antenna comes out of the bottom of the phone and extends away from the user's head, was featured in the October 29 *Aftonbladet*. The paper ran a photo of Dr. Kjell Hansson Mild of Sweden's National Institute for Working Life in Umeå using a phone with an Olé antenna. THE DANGER RAYS ARE ALMOST COMPLETELY REMOVED, a headline explained. The concept is similar to a design patented by Hitachi in 1991 (see *MWN,* N/D96).

Controversy over SARs and phone safety was touched off in Europe this summer when Hagenuk launched an ad campaign with the slogan, "Low radiation is better" (see *MWN,* S/O97). Now the company says it has been subjected to pressure and threats from the rest of the wireless industry. "Networks and service providers have fought hard against our position," Hagenuk's Detliv Driemeier wrote to *Aftonbladet*. "Since we are dependent on these market structures, we bowed to the pressure and pursued a toned-down ad campaign."

"I feel threatened by representatives of the industry," Hagenuk's Swedish representative told the paper. He complained that Arvid Brandberg of the MTL called to put pressure on him as soon as the Hagenuk ad campaign began. "It's scandalous that people still try to conceal the radiation levels," he added. Brandberg did not respond to a request for comment.

"Parts of the industry are run by lawyers who don't want SAR results to be published," Kuster said in an interview.

K-Tip told its readers about recent Australian mouse experi-

What About U.S. Phones?

All phones tested by Kuster for Swiss television complied with European and international exposure standards. But simple calculations suggest that analog phones of the same design would violate U.S. limits.

U.S. analog cellular phones have a maximum antenna input power of 0.6 W. If the 0.25 W phones tested by Kuster were operated at 0.6 W, this would result in significantly greater SARs—2.4 times higher.

In addition, under FCC rules, SARs are estimated in a way that is stricter than under European standards: SARs are determined by averaging the energy absorbed over 1 g of tissue, instead of 10 g. This change increases SARs by about 50%.

Thus, if the phones tested by Kuster were operated at 0.6 W, and their SARs were averaged over 1 g of tissue, most would exceed the FCC's 1.6 W/Kg standard. The SARs of two models would be three times the level allowed by the FCC (see table, p.11).

Kuster confirmed that SARs increase linearly with increasing power, but added that they can also be affected by the configuration of the electronics, the casing of the phone and other factors. "To get more than a very rough estimate," he cautioned, "you would have to measure the phones."

Dr. Quirino Balzano of Motorola in Plantation, FL, argued that extrapolating SARs from Kuster's measurements to other phones could be misleading, "because the guts of the radio in Europe can be very different."

"For the Motorola StarTac," Balzano told *Microwave News,* "I've seen both the U.S. and European models and they are about the same." For this phone, he said, such an estimate would probably be acceptable, but for others it might not be.

Kuster measures phones in up to 16 positions (see notes to table at right). "To me, this is an unnatural way of testing," said Balzano. "In real-life use, the numbers would be lower." He noted that in the U.S., the FCC calls for testing phones only in the normal position—directly alongside the ear and mouth. SAR figures for both the Hagenuk and StarTac phones would be similar under either testing protocol, he said, "but I think the other phones are getting a bit of a shaft."

"If you watch someone using a cell phone, you'll see that they move the phone around," argued Kuster, "and small shifts can have a big effect." He described one prototype antenna with an SAR of 0.2 W/Kg in the standard position, but 3.5 W/Kg when tilted towards the head by only 20Y "The tests reflect real-life use, not the 'worst-case' position, which would result in much higher SARs," he said.

Ranking Mobile Phones: Radiation Absorbed by the Human Head

Manufacturer & Model No.	Antenna Type*	Measured SAR (W/Kg) 0.25 W Antenna Input Power	Estimated SAR (W/Kg) 0.6 W Antenna Input Power		Antenna Efficiency†	Price (SwFr‡)
		Averaged over 10 g	Averaged over 10 g	Averaged over 1 g		
Hagenuk GlobalHandy	B	0.28	0.7	1.0	83	379
Motorola StarTac	D	0.33	0.8	1.2	41	1,190
Sony CM-DX1000	D	0.41	1.0	1.5	98	379
Nokia 8110i	H	0.73	1.7	2.6	39	719
Motorola d160	D	0.81	1.9	2.9	ø	289
Sony CMD-Z1	D	0.88	2.1	3.2	100	789
Ericsson GF788	H	0.91	2.2	3.3	50	849
Ericsson GH688	H	0.95	2.3	3.4	55	599
Panasonic EB G500	D	0.98	2.3	3.5	98	589
Sharp TQ G700	D	1.01	2.4	3.6	80	499
Philips Genie	D	1.05	2.5	3.8	28	998
Nokia 1611	H	1.06	2.5	3.8	67	319
Philips Diga	H	1.06	2.5	3.8	44	379
Ascom Axento	D	1.25	3.0	4.5	72	590
Bosch M-COM 906	D	1.32	3.2	4.8	61	639
Ascom Elisto	H	1.33	3.2	4.8	28	299

*Antenna types: B—Built-In; D—Dipole; H—Helix †Relative scale: Sony CMD-Z1=100 ‡1 SwFr≈$0.68 ø=Not measured

The first column of SARs shown above were measured in Dr. Niels Kuster's Laboratory for EMF and Microwave Electronics at the ETH in Zurich, Switzerland. They were first released on the Swiss television show *Kassensturz* on October 21. The following day, they appeared in the Swedish tabloid *Aftonbladet* and the Norwegian newspaper *Verdens Gang*. *Aftonbladet* also listed the efficiency of each of the antennas, which are reproduced here on a relative scale. According to Kuster, these efficiencies are not very accurate (see article below).

Each phone was tested in up to 16 different configurations, as specified by the European standards group CENELEC: with the phone placed on the right and left sides of the mannequin's head in each of four different positions (see *MWN,* S/O97) and, when appropriate, with the antenna extended and collapsed. After identifying the configuration with the highest SAR, Kuster then measured two other phones of the same model in that configuration. The SARs presented in the first column above are maximum values: the average of these three measurements plus the standard deviation.

The measurements reflect the maximum SAR for 90% of users, including children, with a precision of better than ±25%, with a repeatability of ±5%. (See N. Kuster et al., "Dosimetric Evaluation of Hand-Held Mobile Communications Equipment with Known Precision," *IEICE Transactions on Communications, E80-B,* pp.645-652, May 1997. The journal is published in Japan.)

All the phones tested were digital GSM units operating at 900 MHz, with a nominal maximum antenna input power of 0.25 W (time-averaged). In the U.S., analog hand-held phones operate at up to a maximum of 0.6 W. Included above are *Microwave News'* estimates of SARs for this higher operating power. These were calculated with a simple linear transformation: The SARs at 0.6 W are 2.4 times those at 0.25 W.

Kuster measured SARs averaged over 10 g of tissue, as specified in European standards,which limit SARs to 2 W/Kg. In the U.S., the FCC follows the ANSI/IEEE guidelines, which specify averaging SARs over 1 g, and a maximum SAR of 1.6 W/Kg.

The SARs averaged over 1 g were also estimated by *Microwave News*. The 1 g values presented here are 50% higher than the 10 g values. (See Volker Hombach et al., "The Dependence of EM Energy Absorption upon Human-Head Modeling at 900 MHz," *IEEE Transactions on Microwave Theory and Techniques, 44,* pp.1865-1873, October 1996, especially figures 14 and 15. See also Klaus Meier et al., "The Dependence of Electromagnetic Energy Absorption upon Human-Head Modeling at 1800 MHz," *IEEE Transactions on Microwave Theory and Techniques, 45,* pp.2058-2062, November 1997, especially figures 5 and 6. Both papers are from Kuster's lab.)

ments linking cell phone radiation to an increase in cancer (see *MWN,* M/J97). But, the magazine commented, "as long as there is no conclusive evidence, [the industry] wants to continue to profit from the worldwide boom in cellular phones."

Kuster's measurements were carried out with a robot-controlled probe inside a fiberglass model of a human head filled with fluid to mimic the electrical properties of living tissue. His system is used by over 30 labs around the world, including those of Ericsson, Motorola and Nokia.

Aftonbladet also published figures for the "antenna efficiency" of each phone, which compare the amount of power actually transmitted (see above). "These were unofficial numbers and *Aftonbladet* was told not to publish them," Kuster angrily told *Microwave News*. The newspaper got these figures by photographing charts left posted in Kuster's lab. "They are not reliable since we couldn't measure the full three-dimensional radiation pattern," Kuster said. "Nevertheless, this is an important factor since phones use the lowest power needed to communicate with the base station," he added. "The most efficient phones will thus transmit at a lower power."

Toler Microwave Mouse Study: Some Answers, New Questions

Dr. James Toler's mouse study shows no evidence that chronic exposure to low-level microwave radiation promotes cancer, Toler and his U.S. Air Force (USAF) sponsors conclude in the September issue of *Radiation Research*. Inconsistencies between Toler's 1994 report to the USAF and the published paper raise new questions, however, about the interpretation of the study's tumor data.

According to the paper in *Radiation Research (148,* pp.227-234, 1997), the study found "no evidence to suggest" that exposure to 435 MHz radiation affected tumor incidence, tumor onset and growth, or cancer-related mortality among the test animals, which were infected with a virus that induces breast cancer tumors. That conclusion echoes the assessment that Toler, then at the Georgia Institute of Technology in Atlanta, reported to the USAF in June 1994.

Like Toler's report, the paper notes that mammary tumor onset occurred earlier among the exposed animals than among the unexposed controls. Both the report and the paper conclude, however, that the difference ($p=0.09$) is due to chance.

Interestingly, the published paper ignores a statistically significant ($p=0.03$) excess incidence of hemangioma, a benign blood vessel tumor, among the exposed mice. Toler noted the difference in his report to the USAF, but James Merritt and his coworkers at the Armstrong Lab at Brooks Air Force Base in San Antonio omitted this fact when they prepared the paper for publication.

The detailed pathology data, obtained by *Microwave News* but not presented in either Toler's report or the new paper, show that exposed animals with hemangioma outnumbered controls nine to two. Toler maintained in his report that there is no excess incidence if benign tumors are combined with malignant blood vessel tumors (hemangiosarcoma).

The benign and malignant forms of the disease differ greatly, however, Dr. Ted Gansler, a pathologist at the American Cancer Society's national office in Atlanta, told *Microwave News*.

Neither Toler nor Merritt responded to repeated requests for comment. Toler has retired from Georgia Tech.

The data also show that 14 mice in the control group developed hemangiosarcoma, as compared to seven in the exposed group. Toler's report did not indicate whether this difference in malignant tumor incidence is statistically significant, and the USAF is silent on the question.

The paper notes a statistically significant ($p=0.03$) excess incidence of benign "epithelial stromal" tumors in the ovaries of the exposed mice—a finding not cited in Toler's report. Gansler, however, found that tumor classification peculiar. He explained that it combines two types of ovarian tumors that ordinarily are kept separate—epithelial and stromal—since each type corresponds to a different tissue of origin.

Dr. Michael Stedham, the pathologist who conducted the tissue analysis for Toler and the USAF and a coauthor of the *Radiation Research* paper, told *Microwave News* that the "epithelial stromal" nomenclature is indeed commonly used. Stedham, formerly of Pathology Associates International in Frederick, MD, is now a consultant based in Washington state.

The paper maintains that the incidence of these ovarian tumors, whether stromal or epithelial, can be combined with that of other ovarian stromal tumors, whereupon the difference between the exposed animals and the controls disappears, as with the incidence of benign and malignant blood vessel tumors.

Beginning in March 1989, Toler exposed 200 female, mammary tumor-prone mice to 435 MHz radiation pulsed at a rate of 1 kHz and with a pulse width of 1 ∝sec. According to the paper, the frequency and modulation were "chosen to investigate the possible bioeffects of a USAF surveillance tracking radar system (PAVE PAWS)," which is "capable" of emitting such a signal. The intensity of the radiation was 1 mW/cm^2, resulting in an average specific absorption rate (SAR) of 0.32 W/Kg. The mice were exposed for approximately 22 hours a day, seven days a week for 21 months, concluding in December 1990.

The USAF released Toler's report to *Microwave News* in April 1996 under the Freedom of Information Act, after denying its existence for almost a year (see *MWN,* M/A97).

The three-year interval between the report's submission to the USAF in 1994 and publication of the paper is shorter than the delay in the publication of Dr. Bill Guy's long-term microwave exposure study of rats. Guy reported his study to the USAF in 1985, but it did not appear in a journal until 1992 (see *MWN,* J/A84, Mr85 and J/F93). That report remains one of the most controversial in the microwave bioeffects literature. The USAF and Guy have long maintained that it shows no microwave-cancer link, while others, including the FDA, see the study as indicating enhanced cancer promotion by microwave radiation (see also p.18 and *MWN,* N/D86 and M/A97).

Push To Overturn Federal Preemption of Antenna Siting

Momentum is building for an end to federal preemption of state and local authorities on the siting of wireless antennas. Bills have been introduced in Congress and petitions filed in federal courts to restore local control.

On October 30, Sen. Patrick Leahy (D-VT) introduced a bill (S.1350) that would reverse parts of the 1996 Telecommunications Act to allow communities to adopt stricter rules for public exposure to radiofrequency and microwave (RF/MW) radiation from cellular transmitters. Leahy's target is the act's federal preemption clause, under which state and local officials cannot include RF/MW health considerations in siting plans, provided antennas comply with the FCC's limits (see *MWN,* M/A96).

"I do not want Vermont turned into a giant pincushion" with antennas "sprouting on every mountain," Leahy told the Senate on introducing S.1350. Rep. Bernie Sanders (I-VT) is sponsoring a similar bill (H.R.3016) in the House of Representatives.

The wireless industry has moved quickly to quash the initiative. "This approach is not the right one," the CTIA's Jeff Nelson told *Microwave News.* Jay Kitchen, president of the Personal Communications Industry Association (PCIA), went further, describing S.1350 as "the most anticonsumer plan to come out of Washington in years."

Leahy's bill also prohibits federal preemption for the siting

of digital television (DTV) transmitters. Last summer, the FCC asked for public comment on a proposal, put forward by the broadcasting industry, to deny states and localities a say in DTV antenna siting (see *MWN,* S/O97). In a letter to President Bill Clinton, Vermont's Democratic Gov. Howard Dean warned that the proposal would "eviscerate state land use control law."

As to the Leahy and Sanders bills' chances in Congress, the CTIA's Nelson said that there is "no great concern that they will go anywhere." S.1350 must pass through the Commerce Committee, chaired by John McCain (R-AZ). Pia Pialorsi, the committee's press officer, told *Microwave News* that McCain "does not believe it is the answer" to the antenna siting problem.

Meanwhile, in several different actions in November, cellular activists, local officials and organized labor asked federal appeals courts to set aside the FCC's rules on RF/MW exposure and issue interim rules "sufficient to protect the environment and public health" while the FCC develops a new standard.

The Ad Hoc Association of Parties Concerned About the FCC RF Health and Safety Rules filed petitions in Washington and San Francisco on November 12. David Fichtenberg, a critic of the FCC's RF/MW rules based in Olympia, WA, organized the group (see also *MWN,* M/J97).

The petitions contend that the FCC's RF/MW rules are "arbitrary" and that the FCC does not require sufficient proof of compliance (see *MWN,* S/O97). John Schulz, an attorney based in San Rafael, CA, who is representing the petitioners, maintains that the FCC's science review for the RF/MW rules is flawed because the commission ignored the EPA's advice to include findings on nonthermal effects (see *MWN,* J/F94). "That's a pretty interesting position for the FCC to take," Schulz told *Microwave News,* noting that the FCC "does not consider itself an expert" on public health.

The Communications Workers of America filed a similar petition in Washington on November 12 which argues that the FCC's RF/MW rules are "beyond the scope of the agency's delegated authority."

The Cellular Phone Task Force, also represented by Schulz, filed a petition in New York City on November 10 contending that the FCC's RF/MW rules violate the civil rights of electrosensitive people.

Romanians To Study Health of Radar Workers

Romanian researchers will soon begin a health survey of radar operators and technicians. "Civilian radar workers are complaining of health problems, including allergies, and there are reports of a high mortality rate in the 45-55 age group," the team's physicist, Simona Miclaus of the Army Academy in Sibiu, told *Microwave News.*

Physicians at the academy and at the Sibiu Military Hospital will examine approximately 30 civilians and military personnel. Preliminary results may be available at the end of 1998, Miclaus predicted.

"Conditions in radar-related occupations are bad in our country," Miclaus emphasized. Much of the radar equipment in use is more than 20 years old and leaks significant amounts of radiation, she explained.

In March 1996, the Romanian Labor Ministry issued new limits for occupational RF/MW exposures identical to the International Radiation Protection Association's (IRPA) guidelines (see *MWN,* Mr84 and J/F88). Miclaus reported, however, that the government offers a 10% pay increase to workers exposed to levels exceeding the IRPA limits.

Miclaus said that the Sibiu team will build on the RF/MW exposure studies of Dr. Stanislaw Szmigielski of the Military Institute of Hygiene and Epidemiology in Warsaw, Poland (*MWN,* Mr85, J/F87 and M/J95), and those of Drs. Jasminka Goldoni and Vera Garaj-Vrhovac of the University of Zagreb, Croatia (see *MWN,* J/F92).

"MICROWAVE NEWS" FLASHBACK

Years 15 Ago

• A Canadian federal task force recommends allowing women who work with VDTs to transfer to other jobs during pregnancy without pay loss.

• Dr. Lennart Tomenius, a Swedish epidemiologist, links childhood cancer to power lines. Dr. Nancy Wertheimer says, "It feels good not being out there all alone anymore."

• With nine radar-exposure cases working their way through U.S. courts, word leaks out about Ronald Karras's $200,000 settlement from GE and Western Electric. Karras claimed that radiation from Nike Hercules radars made him deaf and caused his eyes to bleed.

Years 10 Ago

• Drs. Craig Byus and Ross Adey report that the activity of ODC, an enzyme linked to cellular growth, increases when tumor cells are exposed to weak EMFs.

• EMI is suspected as the cause of five Black Hawk helicopter crashes in five years. The U.S. Army denies the claim but increases shielding on its Black Hawks.

Years 5 Ago

• CIRRPC, a White House advisory group, says EMFs are not a public health hazard and recommends against any expansion of EMF research.

• A Swedish electrician's brain tumor is declared a work-related injury, marking the first time occupational exposure to EMFs is recognized as a cause of cancer in Sweden.

• ANSI adopts new RF/MW safety guidelines endorsed by the IEEE, but questions the balance of the IEEE committee that developed them.

• A lawyers' group charges that EPRI slanted funding toward studies likely to provide evidence against an EMF–cancer link.

FROM THE FIELD

Clippings from All Over

Madrid: If there's $25 million that was intended to be spent on cancer-related research, I think that money should have been spent that way. Instead, it was spent on other things.

CBC: Like what?

Madrid: A lot of money was spent on PR.

CBC: How much of that budget has actually gone towards studies on brain cancer?

Madrid: I don't know. And that's a problem. I suspect not very much.

—John Madrid, a consultant to Toshiba, on the CTIA's WTR cellular phone research program, interviewed on *Undercurrents,* a television news show produced by the Canadian Broadcasting Corp. (CBC), September 30, 1997 (see also p.9)

"It's like trying to find an astronaut that hadn't worked for NASA."

—Gene Zastrow, manager of Sutro Tower Inc., on a proposal to disqualify any RF health expert with industry links from reviewing an environmental impact statement on DTV broadcasting from Sutro Tower in San Francisco, quoted by Carol Dimmick in "Lobbyist Plots Course for Health Dept., Sutro Tower EIR," *City Voice* (CA), p.10, September 16-October 14, 1997

The solicitude for unimpaired photography was not extended to public health authorities, milk producers, and certainly not to the general public.

—Daniel Greenberg on "hot spot" information given to Eastman Kodak from 1951 to 1962 to protect the company's film supplies from nuclear fallout, in "Hidden Data and Abuse in Research Come To Light in the USA," *The Lancet* (U.K.), p.1083, October 11, 1997

"Eventually there will be litigation from antennas on rooftops. Someone will accuse a company claiming personal harm or injury....It is almost inevitable that someone will accuse a carrier of something like cancer and blame it on the antennas. The problem is the industry has to educate the public about RF. Is it dangerous? Yes, under certain circumstances. Can it be managed? Yes. Quite a few in site management don't know what it is though."

—Ron Gibbs, President and CEO, Lodestar Towers, Tequesta, FL, quoted by Cindy Loffler Stevens in "The RF Emissions Issue," *Wireless Business & Technology,* p.77, October 1997

"Knowing the results earlier rather than later can be extremely valuable. That's one reason that EPRI is a sponsor."

—Chuck Hakkarinen, Electric Power Research Institute (EPRI) representative and chair, ACACIA Executive Board, explaining EPRI's sponsorship of research on climate change, quoted in "ACACIA: A Consortium for the Application of Climate Impact Assessments," *EPRI Environment Update,* p.10, September 1997

"There is a lot of evidence going around that shows something is going on" that could allow low-intensity microwaves to affect the brain.

—Dr. Frank Barnes, University of Colorado, Boulder, quoted by Tim Beardsley in "Say That Again? Researchers Plan To See If Cell Phones Affect Memory," *Scientific American,* p.20, December 1997

Individual governments...should reject pending licence applications from Iridium, which wants to operate a multisatellite mobile telephone system with no guaranteed protection for radioastronomy frequencies. The customers of Iridium, and similar companies, must be forced in this way to pay for nonpolluting systems.

—"Make Radio Polluters Pay: Governments Need To Do More To Curb Pollution of Astronomically Essential Radio Bands," Editorial, *Nature* (U.K.), p.101, November 13, 1997

Letter to the Editor

CDMA vs. TDMA: Health Impacts

November 17, 1997

To the Editor:

I believe that the European—and planned world—GSM digital mobile phone standard will be found to have been a disastrous choice. GSM signals appear to be biologically active and capable of causing disabling health effects.

New evidence shows that the regular pulsing of GSM signals disrupts important biological processes.[1,2] While Time Division Multiple Access (TDMA) systems (e.g., GSM and TIA IS-54) emit regular short bursts of high-energy data pulses at extremely low frequencies (ELF), the Code Division Multiple Access (CDMA) digital system (e.g., TIA IS-95) emits a far more continuous stream of data with very little periodicity.[3] Indeed, as far as our bodies are concerned, the CDMA signal resembles a noisy, fully amplitude-modulated, analog signal. The handsets can also run at considerably lower peak transmission power than those using GSM.

In the long run, microwaves may play a role in the development of cancer. However, it is becoming increasingly clear that the regular pulsing of the TDMA signal may cause neurological problems in the short and medium terms. GSM, IS-54 and digital cordless (DECT) phones deliver sharp-edged ELF magnetic pulses with an amplitude of several microtesla into the user's head. These pulses arise due to current surges from the battery.[3] Most studies have only simulated the microwave signals and ignored these magnetic ELF pulses.

I believe that the headaches, fatigue, confusion, memory loss and anxiety problems that are now being regularly reported by users of GSM phones will be confirmed in the large-scale EC-funded study which is due to be completed next February.[4] Memory loss, which can eventually appear as permanent dementia, does not appear to occur with the use of analog mobile phones.

On the other hand, I do not believe that memory and dementia problems will be seen among users of the IS-95 CDMA system. South Korea has selected this technology for its second-generation cellular system, making it a good place for an epidemiological study.

If the CDMA signals do not produce early dementia effects, the imperatives of public health would justify scrapping the GSM and IS-54 systems and replacing them with the safer CDMA digital system.

Alasdair Philips, Consultant
2 Tower Rd., Sutton, Ely, Cambs. CB6 2QA, U.K.
<aphilips@gn.apc.org>

[1] L.M. Penafiel et al., "Role of Modulation on the Effect of Microwaves on Ornithine Decarboxylase Activity in L929 Cells," *Bioelectromagnetics, 18,* pp.132-141, 1997.

[2] H. Lai, A. Horita and A.W. Guy, "Microwave Irradiation Affects Radial-Arm Maze Performance in the Rat," *Bioelectromagnetics, 15,* pp.95-104, 1994.

[3] J.B. Andersen and G.F. Pedersen, "The Technology of Mobile Telephone Systems Relevent for Risk Assessment," *Radiation Protection Dosimetry, 72,* pp.249-257, 1997.

[4] The study is being carried out by a Norwegian-Swedish research team—see *Microwave News,* p.10, N/D96. See also p.6 of this issue.

CONFERENCES

1998 Conference Calendar (Part I)

Web site addresses are in italics. Part II will appear in our next issue.

January 5-9: **4th International Conference on Millimeter and Submillimeter Waves and Applications,** Town and Country Hotel, San Diego, CA. Contact:Prof.Mohammed Afsar, Dept. of Electrical Engineering and Computer Science, Tufts University, Medford, MA 02155, (617) 627-3219, Fax: (617) 627-3220, E-mail: <mafsar@emerald.tufts.edu>.

January 5-9: **International Union of Radio Science (URSI) National Radio Science Meeting,** University of Colorado, Boulder. Contact for Commission K on Electromagnetics in Biology and Medicine: Dr. James Lin, Dept. of EECS, M/C 154, University of Illinois, 851 S. Morgan St., Chicago, IL 60607, (312) 413-1052, Fax: (312) 413-0024, E-mail: <lin@eecs.uic.edu>, <*cires.colorado.edu/ursi/rfp.html*>.

January 6-9: **7th Joint Magnetism and Magnetic Materials: Intermag Conference,** Hyatt Regency Embarcadero, San Francisco, CA. Contact: Diane Suiters, Courtesy Associates, 2000 L St., NW, Suite 710, Washington, DC 20036, (202) 973-8668, Fax: (202) 331-0111, E-mail: <magnetism@courtesyassoc.com>, <*www.aip. org/edops/mmmconf.html*>.

January 12-14: **2nd RAPID Science Review Symposium: Epidemiological Research Findings,** Camberley Gunter Hotel, San Antonio, TX. Contact: Dr. Mary Wolfe, NIEHS, PO Box 12233, Research Triangle Park, NC 27709, (919) 541-7539, Fax: (919) 541-0144, E-mail: <wolfe@niehs.nih.gov>.

January 26-29: **Short Course on Management of Electromagnetic Energy Issues: Relevant Strategies,** Fairmount Hotel, San Antonio, TX. Contact: Amy Nelson, Electromagnetic Energy Association (EEA), 1255 23rd St., NW, Suite 850, Washington, DC 20037, (202) 452-1070, Fax: (202) 833-3636, E-mail: <anelson@elecenergy. com>, <*www.elecenergy.com*>. The EEA may not hold an annual meeting in 1998.

January 31-February 5: **1998 IEEE Power Engineering Society (PES) Winter Meeting,** Hyatt Regency Westshore, Tampa, FL. Contact: J. Howard, Tampa Electric Co., PO Box 111, Tampa, FL 33601, (813) 228-4653, Fax: (813) 228-1333, E-mail: <j.howard@ieee.org>, <*www.ieee.org/power/wm98prev.htm*>.

February 15-19: **2nd International Conference on Bioelectromagnetism,** Monash University, Melbourne, Australia. Contact: Irene Thavarajah, Office of Continuing Education, Monash University, Wellington Rd., Clayton, VIC 3168, Australia, (61+3) 9905-1344, Fax: (61+3) 9905-1343, E-mail: <irene.thavarajah@adm.monash.edu.au>.

February 23-25: **Wireless '98,** World Congress Center, Atlanta, GA. Contact: Cellular Telecommunications Industry Association, Suite 200, 1250 Connecticut Ave., NW, Washington, DC 20036, (202) 785-2842, Fax: (202) 785-0721, <*www.wow-com.com*>.

March 1-5: **1998 Annual Meeting of the Society of Toxicology,** Washington State Convention Center, Seattle, WA. Contact: Society of Toxicology, 1767 Business Center Dr., Suite 302, Reston, VA 22090, (703) 438-3115, Fax: (703) 438-3113, E-mail: <trish@toxicology.org>, <*www.toxicology.org*>.

March 21-26: **29th Annual Meeting of the Environmental Mutagen Society (EMS),** Disneyland Hotel, Anaheim, CA. Contact: Maureen Thompson, EMS, 11250 Roger Bacon Dr., Suite 8, Reston, VA 22090, (703) 437-4377, Fax: (703) 435-4390, E-mail: <emsdmg@aol.com>.

March 22-26: **EPRI Course on Design of Underground Transmission Systems,** Holiday Inn Downtown, Denver, CO. Contact: Kathleen Lyons, EPRI, PO Box 10412, Palo Alto, CA 94303, (650) 855-2656, Fax: (650) 855-8997.

April 1-2: **34th Annual Meeting of the National Council on Radiation Protection and Measurements (NCRP),** Crystal City Marriott, Arlington, VA. Contact: NCRP, 7910 Woodmont Ave., Suite 800, Bethesda, MD 20814, (301) 657-2652, Fax: (301) 907-8768, <*www.ncrp.com*>.

April 6-9: **3rd RAPID Science Review Symposium: *In Vivo* and Clinical Research Findings,** Hyatt Regency at Civic Plaza, Phoenix, AZ. Contact: Dr. Mary Wolfe, see January 12-14 above.

April 6-9: **Annual Convention of the National Association of Broadcasters (NAB),** Las Vegas, NV. Contact: Kathy Muller, 1771 N St., NW, Washington, DC 20036, (202) 775-3527, <*www.nab.org/conventions*>.

April 14-16: **60th Annual Meeting of the American Power Conference,** Marriott Downtown Hotel, Chicago, IL. Contact: Robert Porter, Illinois Institute of Technology, Chicago, IL 60616, (312) 567-3196, Fax: (312) 567-3892, E-mail: <apc@iit.edu>, <*www.apc.iit.edu*>.

April 18-24: **6th Scientific Meeting and Exhibition of the International Society for Magnetic Resonance in Medicine (ISMRM),** Convention and Exhibition Center, Sydney, Australia. Contact: ISMRM, 2118 Milvia St., Suite 201, Berkeley, CA 94704, (510) 841-1899, Fax: (510) 841-2340, E-mail: <info@ismrm.org>, <*www.ismrm.org*>.

April 24-May 1: **57th Annual American Occupational Health Conference,** John Hynes Memorial Convention Center, Boston, MA. Contact: American College of Occupational and Environmental Medicine, 55 W. Seegers Rd., Arlington Heights, IL 60005, (847) 228-6850, Fax: (847) 228-1856, <*www.acoem.org*>.

April 26-29: **Electricity '98 Conference and Exposition,** Metro Convention Center, Toronto, Canada. Contact: Canadian Electricity Association, 1155 Metcalfe St., Sun Life Bldg., Suite 1120, Montreal, PQ H3A 2V6, Canada, (514) 866-6121, Fax: (514) 866-1880, E-mail: <info@canelect.ca>, <*www.canelect.ca/e98.html*>.

April 26-30: **8th International IEEE PES Conference on Transmission and Distribution Construction, Operation and Live-Line Maintenance (ESMO '98),** Renaissance Orlando Resort, Orlando, FL. Contact: ESMO '98 Registration, 9800 Metcalf Ave., Overland Park, KS 66212, (913) 967-7299, Fax: (913) 967-1898.

May 12-14: **IEEE Radar Conference,** Sheraton Hotel, Dallas, TX. Contact: Scott Ramey, 2501 W. University, MS 8056, McKinney, TX 75070, (972) 952-4409, Fax: (972) 952-3071, E-mail: <sramey@ti.com>, <*www.ieee.org/tag/section1.html*>.

May 17-20: **30th Annual National Conference on Radiation Control,** Mesa, AZ. Contact: Conference of Radiation Control Program Directors, 205 Capital Ave., Frankfort, KY 40601, (502) 227-4543, Fax: (502) 227-7862, E-mail: <cariganlin@aol.com>, <*www.webpub.com/crcpd*>.

May 18-20: **Instrumentation and Measurement Technology Conference (IMTC/98),** St. Paul Hotel, St. Paul, MN. Contact: Robert Myers, 3685 Motor Ave., Suite 240, Los Angeles, CA 90034, (310) 287-1463, Fax: (310) 287-1851, E-mail: <bob.myers@ieee.org>.

May 18-22: **EMFs: Biological Effects and Hygienic Standards,** Moscow, Russia. Contact: Dr. Nikolay Izmerov, Institute of Occupational Health, Russian Academy of Medical Sciences, Prospect Budennogo 31, 105275 Moscow, Russia, (7+95) 365-0209, Fax: (7+95) 366-0583, E-mail: <izmerov@orc.ru>; or Dr. Michael Repacholi, World Health Organization, 1211 Geneva 27, Switzerland, (41+22) 791-3427, Fax: (41+22) 791-4123, E-mail: <repacholim@who.ch>. See p.16.

May 23-29: **14th International Symposium on Bioelectrochemistry and Bioenergetics,** Vingstedcentret, Denmark. Contact: Dr. Sianette Kwee, Dept. of Medical Biochemistry, University of Aarhus, Bldg. 170, DK-8000 Aarhus C, Denmark, (45) 8942-2869, Fax: (45) 8613-1160, E-mail: <bes98@biokemi.aau.dk>, <*www.health.aau.dk/conf/bes98.htm*>.

May 24-28: **Annual Meeting of the Canadian Radiation Protection Association (CRPA) ,** Ottawa, Canada. Contact: Gary Kramer, President CRPA, Human Monitoring Lab., RPB, 775 Brookfield Rd., PL 6302D1, Ottawa, ONT K1A 1C1, Canada, (613) 954-6668, Fax: (613) 957-1089, E-mail: <Gary_H_Kramer @inet. hwc.ca>.

June 7-11: **1998 Annual Meeting of the Bioelectromagnetics Society,** Trade Winds Hotel, St. Petersburg, FL. Contact: Dr. William Wisecup, W/L Associates, 7519 Ridge Rd., Frederick, MD 21702, (301) 663-4252, Fax: (301) 371-8955, E-mail: <75230.1222@compuserve.com>, <*biomed.ucr.edu/bems.htm*>.

June 14-19: **1998 European Electromagnetics Conference (EUROEM '98),** Dan Panorama Convention Center, Tel Aviv, Israel. Contact: Secretariat EUROEM '98, PO Box 50006, Tel Aviv 61500, Israel, (972+3) 514-0000, Fax: (972+3) 514-0077, E-mail: <euroem98@kenes.com>, <*physics.technicon.ac.il/~peter/euroem98.html*>.

June 15-24: **RAPID Science Working Group Meeting,** Northland Inn and Conference Center, Minneapolis, MN. Contact: Dr. Mary Wolfe, see January 12-14 above.

MICRO WAVE NEWS

Reprints

- ***EMF Litigation*** *($38.50)*
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UPDATES

COST 244bis

New Leadership and Workshop Plans... The European cooperative program for research on biomedical effects of EMFs and EMR—known as COST 244bis—has a new leadership team. Dr. Arne Wennberg of the Department of Neuromedicine at the National Institute for Working Life (NIWL) in Solna, Sweden, takes over as chair from Dr. Zlatko Koren, who died suddenly last August (see *MWN,* S/O97). The vice chairs are Dr. Dina Simunic of the University of Zagreb in Croatia and Joe Wiart of France Telecom in Issy-les-Moulineaux. The working group on epidemiology and human health effects is headed by the NIWL's Dr. Ulf Bergqvist. Dr. Norbert Leitgeb of the Institute for Biomedical Engineering at Graz University of Technology in Austria heads the working group on basic research, while Dr. Guglielmo d'Inzeo of the University of Rome "La Sapienza" leads the working group on engineering and measurements. COST 244bis is planning a series of workshops over the next year: on power deposition in the heads of cellular phone users, in Trento, Italy, December 13-14; on EMFs at intermediate frequencies, in Madrid, Spain, in March or April; on health risks of prolonged EMF exposure, in Graz, Austria, in September; and on biomedical effects of wireless equipment, in Zagreb in November.

MEETINGS

Moscow EMF Seminar... The World Health Organization's (WHO) International EMF Project is holding a seminar, *EMFs: Biological Effects and Hygienic Standards,* in Moscow, May 18-22, 1998. Russian researchers first alerted the world to the possibility of health hazards from EMFs in the early 1970s, but much of their pioneering work on biological effects has been inaccessible due to the language barrier. Russian EMF research "has largely been lost to the scientific community," Dr. Michael Repacholi, the EMF Project's director, told *Microwave News.* The seminar's aim is to bring this research "into the wider community" for evaluation and dissemination. "This large body of evidence must not be ignored," Repacholi stressed. The seminar, which will cover the non-ionizing spectrum from ELF EMFs to microwaves and millimeter waves, will bring Russian and Eastern European scientists together to summarize their work. Although little research has been done on bioeffects from radiation at high microwave frequencies, scientists at the Russian State Research Center's Institute of Biophysics in Moscow recently reported that exposure to 10 GHz radiation can cause memory failure in chicks (see *MWN,* S/O97). Rationales for current standards will also be discussed. For example, Repacholi noted, Russia's State Committee of Sanitary-Epidemiological Surveillance adopted a standard for mobile phones in 1994. Ultimately, Repacholi hopes, Russian findings "can properly be taken into account" in the WHO's assessments of EMF health risks. The seminar will be hosted by the Institute of Occupational Health of the Russian Academy of Medical Sciences. The WHO's EMF Project will publish the proceedings of the seminar in English. For more information, contact the institute's director, Prof. Nikolay Izmerov, or Repacholi (see "Conference Calendar," p.15).

OBITUARIES

Dr. **Samuel Koslov** died of cancer on October 3 at his home in

McLean, VA. Koslov, who was 70, was long involved in the RF/MW health debate and played a key role in the investigation of the irradiation of the U.S. embassy in Moscow. From 1972 to 1978, Koslov served as the principal advisor to the Assistant Secretary of the Navy for R&D. It was during this time that he founded, and served as a member of, the Electromagnetic Radiation Management Advisory Council (ERMAC), which coordinated the government's work on non-ionizing radiation. Koslov then spent 15 years at the Johns Hopkins University's Applied Physics Lab in Laurel, MD, as the assistant director for technical assessment. While at the lab, Koslov worked with Henry Kues on studies of the effects of microwave radiation on the eye.

On November 21, **Gary Poynter** died of a heart attack at the age of 51. Poynter served with the Ohio State Highway Patrol for 15 years. He is best known for his efforts to find out whether his fellow policemen were developing cancer due to exposure to microwaves from radar guns. He published his research findings in *Law Enforcement News* in November 1990 (see *MWN,* M/A91). At the same time, Poynter collected names of officers who had developed cancer after using the radars. Within a few years, he had a list of over 200 officers, many of whom had testicular cancer and melanoma. In 1992, Poynter was prominently featured in a segment on *60 Minutes,* then the most-watched television news show in the U.S. (see *MWN,* M/J92). That same summer, Poynter testified at hearings called by Sen. Joseph Lieberman (D-CT) (see *MWN,* S/O92).

Dr. **Brian Maddock** died of a heart attack on October 11, while on vacation in the Seychelles. He was 63. Starting in 1984, Maddock led the U.K.'s research effort on the possible health effects of EMFs at the Central Electricity Research Labs. After his retirement in 1993, he administered the EMF Biological Research Trust, which was funded by the National Grid Co. Maddock was the chair of a committee that wrote CENELEC's provisional standard for environmental ELF EMFs.

PEOPLE

Dr. **Carl Durney** has retired from the University of Utah. In recognition of his 34 years at the university and his work on RF health studies, the USAF's Armstrong Lab at Brooks AFB sponsored a symposium in his honor October 20-21. Among the speakers at *RF Dosimetry: 25 Years of Progress* were Drs. Eleanor Adair, Om Gandhi, Bill Guy, Don Justesen, John Osepchuk and Herman Schwan....Dr. **Meike Mevissen** has left Dr. **Wolfgang Löscher**'s lab at the School of Veterinary Medicine in Hannover, Germany, where they collaborated on landmark studies on the promotion of breast cancer by EMFs. Mevissen has joined the Institute of Veterinary Pharmacology at the University of Bern in Switzerland. She said that she is still consulting with Löscher on follow-up breast cancer studies....Dr. **Valerio Canè** of the University of Modena's Faculty of Medicine in Italy has been appointed to the editorial board of *Electro- and Magnetobiology.* Canè has been the coordinator of Modena's Interuniversity Center for Interactions Between EMFs and Biosystems since 1992. ...**Thomas Trotter** has been appointed president and CEO of OrthoLogic Corp. in Phoenix. Dr. **Allan Weinstein**, the former chairman and CEO, is now the vice-chair. OrthoLogic makes

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Time after time,
***Microwave News* breaks the story:**

Microwave News, July/August 1995

"Draft NCRP Report Seeks Strong Action To Curb EMFs"

"Leak Links Power Lines to Cancer"

New Scientist (U.K.), October 7, 1995

MWN

Microwave News, July/August 1994

"Digital Cellular Phones Can Disrupt Implanted Pacemakers"

"Cellular Phones May Affect Use of Pacemakers"

Wall Street Journal, April 28, 1995

MWN

Microwave News, November/December 1995

"Higher Leukemia Rates Among Those Living Near Australian TV Towers"

"Living Near TV Towers a Leukemia Risk for Children, Claims Researcher"

Sydney Morning Herald (Australia), December 10, 1996

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bone-healing stimulators and other medical devices....Dr. **Constantine Maletskos**, who is shepherding the NCRP's EMF report through its long review process—two and a half years and counting—is the first recipient of the Evans Medal from the Health Physics Society.

RF EXPOSURE

Goldsmith Argues for Prudent Avoidance... It is time to consider a policy of prudent avoidance for RF exposures, according to Dr. John Goldsmith, an epidemiologist at the Ben-Gurion University of the Negev in Beer Sheva, Israel. "The notion that non-ionizing radiation, and in particular RF radiation, was harmless—the assumption of innocence—is no longer tenable," Goldsmith argues in a commentary in the December issue of the *American Journal of Industrial Medicine (32,* pp.689-692, 1997). Goldsmith was led to this conclusion by recent studies of radio and TV broadcast towers in Australia and the U.K. (see *MWN,* N/D95 and J/F97). "Taken together," he writes, "they suggest that exposures of residents living near (within 5 km) broadcast facilities may have small increases in leukemia." While the size of the increase and the distance at which it may occur are "subjects for legitimate debate and additional studies," Goldsmith believes, various measures of prudent avoidance should now "be debated, and possibly applied." Among these are building new broadcast facilities at least 5 km away from residential areas, and making RF shielding more available and effective for existing housing with a high level of exposure. A second article by Goldsmith, in *Public Health Reviews (25,* pp.123-149, 1997), compares non-ionizing radiation issues today with the social response to air pollution problems in the decades after World War II. Goldsmith joined the California Department of Health in 1957 and led its air pollution research for the next 20 years. He credits the Air Pollution Foundation, funded by the auto and oil industries, for research that "contributed substantially to the understanding of the atmospheric reactions involved." But he recounts in detail how the Lead Industries Association was able to prevent the disclosure of research results that it found inconvenient. He also notes how the auto and oil industries later used their influence to deny funding to research proposals "not on their merits, but on the basis of the information not being of the type...the industries wanted to have in the public domain." On cellular phone research, Goldsmith holds that WTR's epidemiological studies are "unlikely...to produce relevant evidence of excess cancer, since they were done too soon after exposure to accommodate the known latency of 10-15 years for radiation-induced solid tumors" (see also p.6 and p.12). And Goldsmith is harshly critical of the decision by Dr. Michael Repacholi and his industry sponsors to delay announcing the results of Repacholi's own study of RF–exposed mice, which found an increase in lymphomas (see *MWN,* M/J97). While noting that there is no proof that cellular phones have caused any increase in cancer, he argues that there is "abundant evidence" that RF exposure has the potential to increase risk of the disease. "Today's situation resembles the situation for carbon monoxide exposure from motor vehicles in the 1960s," Goldsmith writes. Although much more research is needed, he contends, any "delay in protective measures" is likely to mean more cases of cancer.

VIEWS ON THE NEWS

Freedom of Information and the Cellular Marketplace

It all started with an ad campaign. Last summer, a small cellular phone maker rolled out the slogan, "Low Radiation is Better." The German firm Hagenuk bragged that its phones exposed users to less microwave radiation than any others on the market.

The company's ads caused quite a stir (see *MWN,* S/O97). But while Hagenuk compared the specific absorption rate (SAR) of its GlobalHandy phone with industry averages, it did not name names or give specific numbers for its competitors.

The competitors weren't talking, either. The wireless industry wants to keep these numbers under wraps. In fact, Hagenuk now says its ad campaign was toned down in response to industry pressure.

But consumers want to know. A Swiss consumer TV show stepped into the breach and commissioned its own survey. Now the information is out, and people who want a low-radiation phone know which models to consider—at least in Europe.

All this reminds us of another piece of consumer electronics whose safety was questioned: computer video display terminals, or VDTs. When first introduced, VDTs exposed the user to EMF levels that were high enough to cause public concern. But the radiation levels of most units sold today have been drastically reduced. It was consumer demand that changed the situation.

For VDTs, Sweden was the key. An ad hoc committee there was the first to adopt a rigorous testing protocol, and a set of emission standards—known as MPR2—that manufacturers acknowledged was readily achievable. Mandatory limits were never imposed. The Swedish government, the country's largest single buyer, simply made it clear that it would not purchase any VDTs for which EMF levels were not available. The cost of lower emissions turned out to be less than $1 per unit.

Low-emission monitors soon became the norm. This reflects a precautionary approach. Then, as now, there were more questions than answers on EMF health effects, and no definitive proof of a problem. But consumers quite reasonably did not want to be the guinea pigs. Given the choice, they preferred the VDTs that conformed to Swedish standards.

Computer monitor EMF levels were pushed even lower, not by the Swedish government but by a labor union. TCO, the federation of white-collar workers, was not satisfied with existing guidelines, and it relentlessly pushed industry to answer the question, "How low can you go?" TCO set its own standard, and a growing number of big companies soon won the TCO seal of approval.

Let's be clear: Neither MPR2 nor the TCO guidelines are health standards. They are engineering standards, limits that are "as low as reasonably achievable." But if the Swedes had decided to wait for enough EMF research to set health-based limits, they'd still be waiting. The industry was in no rush to find out if there was a health risk—as is the case today with cellular phones.

Indeed, we still don't have a clear picture of whether VDT radiation is harmful to health. But today the levels are so much lower that it doesn't matter much anymore. Any potential danger has been drastically reduced—because consumers wanted it that way.

VDTs represent a market-driven success story. But as any economist will tell you, markets only work when consumers have full information about competing products. And there's the rub. Most cellular phone makers don't want consumers to know how much radiation their phones put out.

In the U.S., the FCC now requires cellular phone makers to show that their products comply with its new exposure standard (see *MWN,* J/A96). In theory, the SAR for every new phone is publicly available information. In practice, it is filed in a way that is confusing and inaccessible. "Consumer-friendly" it's not; based on our own experience, we'd call it "consumer-hostile."

Committees are now refining U.S. testing protocols for SAR measurements. Unfortunately, the FCC has so far required only that phones be tested in a single position. People do not stand like statues when they use a cellular phone, and Europe's CENELEC protocol requires testing in many positions to reflect this normal variation. Testing in multiple positions is the only way to get a realistic picture, and consumers should insist on it.

As wireless phones become ubiquitous, they will be used not just by busy executives, but by everyone. A teenager slouching on the couch, a five-year-old child who has no idea what an antenna is, your elderly aunt calling from the basement of her church—all will experience different SARs, and testing procedures must cover them all.

We should not be surprised if the U.S. government turns out to be less than zealous about getting consumers the information they need. The FCC is not a health agency, and one of its mandates is to encourage the growth of the telecom industry. And the health agencies have been happy to stay in the shadows. Maybe some U.S. consumer group—Consumers Union, perhaps—will fill this gap by conducting tests of its own.

After all, inquiring minds want to know. And in the long run, as the cyber-saying has it, "Information wants to be free." One way or another, these numbers will eventually come out, and will start to have an impact on sales.

Today the industry is reported to spend less than $1 on each phone's antenna, and the Hagenuk phone is among the less expensive digital models in Europe. The cost of low-radiation phones is likely to be quite reasonable.

Research on RF/MW radiation bioeffects is important, for both scientific and public health reasons. But there are powerful social forces that ensure it will move forward at a glacial pace.

So which would you rather have under your Christmas tree—reliable SAR measurements for the top 20 cellular phones, or another five-year plan from WTR?

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Major U.S. Cancer Lawsuit Ends: An EMF Era Comes to a Close?

Plaintiffs Cite Lack of Clear Evidence

A major lawsuit over childhood cancer and electromagnetic fields (EMFs) was withdrawn on October 14, a move that may represent the end for such litigation in the United States. Citing "the uncertain state of the scientific evidence," plaintiffs Melissa and Suzanne Bullock of Guilford, CT, announced that they had decided to drop their suit against Connecticut Light & Power Co. and its parent company, Northeast Utilities in Hartford, CT. The case had been scheduled to go to trial in January 1999.

After a key expert witness pulled out, the Bullocks concluded that they could not go forward with the case. The Bullocks' lawyer, James Horwitz of Koskoff, Koskoff & Bieder in Bridgeport, CT, told *Microwave News* that the withdrawal of Dr. Dennis Spencer was "the straw that broke the camel's back." Spencer, the head of the neurosurgery department at the Yale School of Medicine in New Haven, CT, was slated to testify that EMFs played a role in causing Melissa Bullock's brain tumor.

This left only three of the Bullocks' original five EMF–cancer witnesses. Dr. Carol Westbrook, a research oncologist at the University of Chicago, pulled out last year.

Lawyers who have been involved in other EMF suits expressed differing views on the Bullock case and the future of EMF litigation. "The present state of the science just does not support a claim like this," said utility lawyer Tom

(continued on p.10)

Corporate Interference Charged over Disclosure of EMI to Pacemakers

Sensormatic Electronics Corp. has repeatedly tried to prevent a Florida cardiologist from disseminating research indicating that one of its anti-theft systems can interfere with cardiac pacemakers.

In a study partly funded by Sensormatic, Dr. Michael McIvor found that an acousto-magnetic system caused electromagnetic interference (EMI) among 48 of 50 pacemaker patients (see *MWN,* S/O97). Two other types of electronic article surveillance (EAS) technology caused EMI rarely or not at all. Sensormatic makes products with all three types of technology, but it is the only manufacturer of acousto-magnetic devices.

Last spring, Sensormatic lawyers demanded that McIvor not discuss his work at medical conferences or with the press. The company then tried to discourage a journal from publishing McIvor's study. After the journal hired its own lawyer, Sensormatic relented, and the paper was published in October (see *MWN,* S/O98).

(continued on p.6)

« Wireless Notes »

Researchers at a workshop at Austria's **University of Vienna** released a statement on RF/MW safety, declaring that, "Biological effects from low-intensity exposures are scientifically established" (see p.5). They called for the development of mobile phones that emit less radiation. Of all those present at the close of the workshop in late October, only Dr. **Michael Repacholi** of the WHO EMF project declined to sign the statement. But he did give an interview to the **Austrian Press Agency** (APA). WHO EXPERT: THERE IS NO DANGER FROM HAND-HELD TELEPHONES was the headline of the APA dispatch. "We are not aware of a single case in which mobile phones or base stations have harmed human health," said Repacholi, according to the APA. Referring to studies of cancer, memory, behavior, blood pressure and cardiac rhythm, he declared, "So far, we have not found signs that there are links." The article did not mention Repacholi's own study, carried out in Australia, which showed a doubling of cancer risk among mice exposed to a GSM signal (see *MWN,* M/J 97). Repacholi was escorted to the interview by the director of an Austrian telecom industry group, **Forum Mobilkommunikation** (FMK). The FMK's Michaela Reeh also sat in on the interview. The next day FMK put out a press release titled WHO EXPERT SOUNDS THE 'ALL-CLEAR' SIGNAL FOR MOBILE COMMUNICATION. Repacholi told *Microwave News* that the FMK press release was too "black and white," and added, "It is absolutely not possible to rebut all the misquotes the press makes about my statements."

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A two-year animal study on the effects of the **Iridium** signal will soon be under way. **Motorola** has signed a contract with **Battelle** Pacific Northwest Labs in Richland, WA, to expose rats to 1616-1626 MHz radiation with TDMA modulation (11 Hz), which is used by the satellite-based phone system. Dr. **Larry Anderson** will lead the study at Battelle. This chronic bioassay "will be not unlike the studies that have been carried out in the past by Dr. Ross Adey in Loma Linda, CA, and by Dr. Joseph Roti Roti in St. Louis," said Norman Sandler, a Motorola spokesperson based in Schaumburg, IL (see *MWN,* J/A95). Sandler explained that Battelle will use an exposure system developed by Motorola and not the one designed by Dr. **C.K. Chou** for WTR (see *MWN,* M/J95). Chou now works for Motorola. Sandler declined to reveal the cost of the study or the number of animals to be exposed. "This gets into information about study design, and the precise details are still to be worked out," he said, adding that, "These details are routinely treated as confidential." Anderson did not respond to repeated requests for comment.

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"There is no evidence, study or causative link between RF radiation and any cancer, disease, malady or condition against the human (or animal) body, other than cell and tissue heating due solely to high-intensity fields." In July, **James Kaplan** of **EDX Engineering Inc.** in Eugene, OR, offered "a month's pay" to anyone who could disprove the previous statement (see *MWN,* J/A98). But faster than you can say "weasel," Kaplan changed the rules. In response to an inquiry from Dr. **Paul Heroux** of the Faculty of Medicine of **McGill University** in Montreal, Canada, Kaplan added a variety of conditions, including, "Human cases only. No mice, please." Heroux told *Microwave News,* "This 'brave' mentality is typical of some engineers, who think they are doing a service by debunking science that they do not really understand."

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Residents of **McLean, VA**, an upmarket Washington suburb, have succeeded in keeping a communications tower out of their neighborhood. On September 30, Judge Claude Hilton of the federal district court in Alexandria, VA, upheld the denial of a permit for the tower. Hilton found the decision to be a lawful use of zoning: to "facilitate the creation of a convenient, attractive and harmonious community," according to the October 8 *Washington Post*. **AT&T Wireless Services** designed the 100-foot structure to resemble a tree to make it less objectionable, but that was not good enough. In July 1997, the Fairfax County Planning Commission turned down the company's request for a permit. AT&T Wireless spokesperson Chris Doherty told *Microwave News* he is convinced that the decision was made in response to pressure

Do Cell Phone Towers Interfere with Homing Pigeons?

Large numbers of homing pigeons have been disappearing during races, and enthusiasts are suggesting that signals from cellular phone towers may be responsible for the birds flying astray. Others point to heightened geomagnetic activity as the cause.

When 700 of 900 birds failed to complete a race from western Pennsylvania to suburban Philadelphia last October 5, the *Washington Post* (October 8) cited a race organizer's suggestion that cell phone towers were to blame.

The next day's *Post* reported that most of the birds released in two other local races in early October failed to return to their lofts. Similar losses occurred in races in Ohio and in the Netherlands, according to recent postings on the Internet (see, for example, the site of Pigeons Worldwide at: <www.pww.nl>).

Last year, the *Irish Times* reported that many Irish pigeon racers had become discouraged after heavy bird losses in recent years. There again, mobile phone towers were a suspected cause.

Asked whether RF/MW radiation could interfere with the birds' homing sense, Dr. Robert Beason of the State University of New York, Geneseo, told *Microwave News,* "No one knows." But Beason, a neurobiologist, noted that flocks of migratory birds have been observed to veer off course in order to avoid radar beams.

Others are more skeptical. Dr. Philip Walton, a physicist at Ireland's University College, Galway, told the *Irish Times* (July 21, 1997) that he considers this type of interference to be "very unlikely"—although, he suggested, communications towers might be visually distracting to the birds.

from the proposed tower's prominent neighbors, who would have included **Edwin Meese**, attorney general under Ronald Reagan, and Dr. **Zbigniew Brzezinski**, national security advisor to Jimmy Carter. In September 1997, the carrier sued, arguing that the county's decision violated the 1996 Telecommunications Act, an assertion Judge Hilton did not accept. In winning its battle with AT&T Wireless, McLean beat the odds; more often, carriers have overcome local opposition to towers by threatening legal action or by invoking the Telecom Act in court. Another exception is **Medina, WA**, the affluent Seattle suburb that is home to software mogul **Bill Gates**. In 1996, Sprint Spectrum challenged the town's moratorium on new wireless towers, but a federal judge upheld the ordinance (see *MWN,* M/J96). The McLean dispute has attracted considerable attention: This summer and fall, the trade magazine *Wireless Week* featured it in a series of four articles on tower siting. No word yet on whether AT&T Wireless will appeal Judge Hilton's ruling.

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In 1994, *Fortune* magazine poked fun at cell phone mogul **Craig McCaw** for suggesting "that the FCC should reserve [part of the broadcast] spectrum for telepathic communications to be made possible by **brain implants** that he thinks will exist one day" (see *MWN,* N/D94). It may turn out that McCaw was once again ahead of the curve: A paralyzed stroke patient in Atlanta is now using a brain implant to send wireless signals to a computer. By moving a cursor on the computer screen from one icon to another, he is able to communicate—despite being unable to move almost any part of his body. Drs. **Roy Bakay**, of **Emory University School of Medicine** in Atlanta, and **Phillip Kennedy**, an Atlanta physician, implanted a small glass cone containing tiny electrodes into the man's motor cortex. Chemical growth factors in the glass encouraged brain cells to grow and connect with the electrodes. The electrodes can then pick up electrical signals from the man's brain and transmit them to a receiver and amplifier on his scalp. No batteries needed—the device is powered by an induction coil placed over his head. "The trick is teaching patients to control the strength and pattern of the electric impulses," commented Dr. Bakay. "After some training, they are able to 'will' a cursor to move and then stop on a specific point on the computer screen." Results from implanting the electrode in a previous patient, disabled by ALS, appear in the June issue of *NeuroReport*. The woman was able to control computer signals in an "on/off" fashion only, but did so for 76 days, until she died from the disease. The stroke patient has done better. He can move the cursor from one icon to another, choosing the one that will make the computer say a particular phrase. Bakay explained that this is just the beginning, saying, "If you can move the cursor, you can...send e-mail, turn on or off a light and interact with the environment."

Talking Wireless Safety in the U.K.

From conference materials distributed at Mobile Phones—Is There a Health Risk?, *held in London (U.K.), October 14-15, 1998.*

Press releases and information to and contact with the media is very important so as not to be caught in an information trap; asbestos and some other incidents still linger....If there is a risk, the risk is, with a very high degree of probability, very small. Other factors are more important, lifestyle, eating and drinking habits and smoking.

—Arne-Egil Moen, Telenor Mobil, Norway, "A Mobile Operator's View on Possible Risks"

Manufacturers of cellular telephones should consider whether it is possible to reduce the user's exposure to microwaves by changing the design of mobile telephones. Manufacturers might also wish to consider whether it would help if mobile telephone users were provided with earphones instead of there being direct contact between the telephone and the ear. One thing manufacturers, employers and insurers should not be is complacent. If commercial considerations are given priority over health and safety, then significant liabilities may [lie] ahead. Asbestos was known as the "magic mineral." Indeed it was. There was a thriving and very profitable asbestos industry. However, the more sinister properties of the magic mineral proved to be the sting in the tail which crippled the insulation industry's profits and those of the insurance industry. Eventually, the asbestos industry was statutorily regulated out of business. Let us hope that history does not repeat itself.

—Kieron West, Edward Lewis Solicitors, London, U.K., "Lessons from Another Industry: The Asbestos Legacy"

No clear scientific evidence of a health problem with mobile phones ....Pressure groups can easily create attention in current media environment....Irrespective of the science, there is a public perception which needs to be addressed....The industry must get its side of the story out through trade associations and by direct company actions to achieve a more balanced media environment....The industry must continue to be financially committed to *good quality* research.

—Mike Short, Cellnet and Federation of Electronic Industries, U.K., "An Industry Response"

Because of the work of WTR the tools and data necessary to protect the health of wireless phone users for the next 25 years are in place.

—Rebecca Steffens, WTR, Washington, "Wireless Technology Research, LLC: The Foundation for Public Health Protection"

Ultimately, mobile phone producers will be unable to fool all the people all the time, with resulting expensive public litigation and private tragedy in families bereft of breadwinners. With the benefit of present scientific knowledge, anyone who habitually still uses a mobile phone for more than 20 minutes at a time needs his or her head examined.

—Roger Coghill, Coghill Research Labs, Gwent, U.K., "Consumer Concerns: Fooling All the People, All the Time?"

Discussion about biological impacts of electromagnetic fields are *highly emotional*. As a result, anxiety and bad feelings dominate the discussions.

—Gerd Friedrich, Forschungsgemeinschaft Funk (FGF), Bonn, Germany, "Research Initiatives,"

How on earth does any health problem manifest itself in the first place without anecdotal evidence?

—John Simpson, Microshield Industries, Luton, U.K., "Anecdotal Evidence—Ignore It at Your Peril"

Norwegian Navy's Cover-Up of Birth Defect Cluster Unravels

An investigation by *Bergens Tidende,* the daily newspaper in Bergen, Norway, has prompted renewed concerns over a cluster of birth defects among the children of sailors who served on the torpedo boat *Kvikk*.

In a report released earlier this year, the Norwegian navy dismissed a possible link between exposures to radiofrequency and microwave (RF/MW) radiation aboard the *Kvikk* and an apparently high rate of birth defects (see *MWN,* M/J98). But in a series of articles in October and November, a team of reporters led by Inge Sellevåg, *Bergens Tidende*'s science editor, documented a number of inconsistencies and omissions in the Norwegian navy's report.

"There is now a great deal of attention on the possible health risks associated with electromagnetic radiation," Trond Kathenes, the leader of the *Kvikk* parents' association, told *Microwave News.* He added that the Norwegian Parliament has taken an interest in the investigation. Kathenes is a former commanding officer of the *Kvikk.* The parents' association had charged that the navy was actively covering up any possible link between serving on the torpedo boat and the cluster (see *MWN,* M/J98, and also J/A96 and S/O97).

Among the findings of Sellevåg's reporting are:

• The 200 kW "Tori Search" tracking radar mounted above the deck often became loose, spraying the deck with radiation in the 8.5-9.6 GHz frequency band. This was well-known to the *Kvikk* sailors and happened frequently—not just in rough seas, according to Kathenes. In contrast, the navy's report maintained that, unless sailors climbed the masts, they were not exposed above exposure limits from this high-power radar.

• While the navy report disclosed very few details on the radiation levels aboard the *Kvikk,* a number of appendixes to the report obtained by *Bergens Tidende* include detailed surveys carried out by a team of American, British, Dutch and Norwegian engineers. Their measurements were largely limited to the radiation from a 750 W high frequency transmitter, however. There appear to have been no radiation surveys of the 200 kW radar or of a second radar with an output power of 25 kW.

• A 1979-1980 radiation survey indicated that there were high RF/MW levels on the *Kvikk*. "The ship can best be described as an electronic mess," said Roald Zweidorff, who made the measurements for the navy. He noted that, while he could not remember the specific exposure levels, he had a clear and strong recollection that he had uncovered "serious conditions" on board the *Kvikk.* Surveys of torpedo boats of the same class as the *Kvikk* yielded similar high readings. A report detailing Zweidorff's measurements could not be found in the navy's files. After 1990, the navy stopped filing reports on radiation surveys aboard the *Kvikk.*

• *Bergens Tidende* reporters visited all the *Kvikk* parents and found that there were 16 children with birth defects among the fathers who served aboard the boat between 1987 and 1994. The navy's report identified only 11 children with birth defects. The newspaper's detailed investigation of the children of the *Kvikk* families appeared on November 21.

• Some of the mothers of the children with birth defects frequently traveled with their husbands aboard the *Kvikk.* One of these women lost two children soon after they were born, and her third child was born with severe brain damage. "We cannot exclude the possibility that the damage of the fetus in [the case of one of the babies who died after birth] was caused by radiation," said Dr. Lorentz Irgens, the head of the Norwegian Birth Defect Registry in Bergen. None of these women were included in the navy's report. Irgens said that the birth defect registry may include the mothers in a follow-up study. He argued that an independent team should be appointed to investigate the cluster.

• Dr. Jan Helge Halleraker, the chief medical officer at Haakonsvern Naval Base, discounted a 1971 study by Dr. Peter Peacock which identified a cluster of birth defects among the children of U.S. helicopter pilots at Fort Rucker, AL. But Halleraker conceded that he had never actually read the original Peacock paper. The navy report dismissed the study by noting that, "[T]he U.S. Air Force conducted a follow-up study that could not confirm any such connection as the one suggested by Peacock." No such study was included in the references listed in the report.

• Dr. Gro Harlem Brundtland, the director-general of the World Health Organization (WHO), has expressed interest in reviewing the *Kvikk* report. For the present, she has reserved judgment as to the adequacy of the navy's investigation. Brundtland, a physician, is a former prime minister of Norway. Dr. Michael Repacholi of WHO's EMF project in Geneva told *Bergens Tidende* that he had not heard of the *Kvikk* cluster or the navy's report.

The Norwegian Radiation Protection Authority in Oslo is reviewing the navy's report. The radiation office's evaluation, which will include a recommendation as to whether further investigation is needed, is due to be completed in mid-December.

The association of *Kvikk* parents has set up a Web site to disseminate information about the investigation: <home.sol.no/~esbenk/kvikk.htm>. A copy of the Norwegian navy's report is posted on the site, both in Norwegian and in English.

Sellevåg told *Microwave News* that *Bergens Tidende* was committed to following the *Kvikk* story. "We will use every resource to pursue this issue," he said.

Cell Phones Still Stir British Press

Cellular phones continue to be a hot topic in the British press. The wave of coverage that began last summer (see *MWN,* J/A98) has continued into the fall, with articles in almost every major newspaper.

A lawsuit by Roger Coghill, a consultant based in Gwent, Wales, got widespread attention. The suit, which demanded that wireless phones be sold with warning labels, was dismissed on November 10 after a two-day hearing. Coghill told the BBC he had spent more than £20,000 (approximately $33,000) on the court action.

Also in the news were the patents for lower-radiation phone designs held by various wireless manufacturers (see *MWN,* N/D96). In a Page One story on October 25, *The Independent* described these as a "'smoking gun' admission" that wireless phones pose health risks. The Federation of the Electronics Industry responded that the patents "are not an admission that phones are unsafe."

Activists Launch New Group As EMR Alliance Fades Away

There is a new national grassroots organization to voice concerns about public exposures to electromagnetic radiation. A group of activists from across the country founded the EMR Network over the weekend of November 14-15 in Fairlee, VT.

"We're going to concentrate on RF/MW radiation issues," Libby Kelley, the executive director of the network, told *Microwave News*. She explained that the group would address public health issues related to cellular phones and towers, radio and TV broadcasting and radar.

Power line issues will also be on the network's agenda. "We're not abandoning EMFs," said Blake Levitt of New Preston, CT. Levitt, a journalist and the author of *Electromagnetic Fields: A Consumer's Guide to the Issues and How To Protect Ourselves,* helped organize the Vermont meeting, along with Kelley and Janet Newton of Cabot, VT, a cell tower opponent.

The network has emerged as the EMR Alliance in New York City, a group established by power line opponents, has become dormant over the last year. Cathy Bergman, the alliance's president, was invited to the Vermont meeting but did not attend.

In recent months, phone calls and E-mail to the alliance have often gone unanswered. *Network News,* its quarterly newsletter, has not appeared since the fall of 1997. Bergman declined to be interviewed, but in a press release issued by the network, she said, "I pass the torch" to the new group.

Kelley already heads the Citizens of Marin for Sensible Communications Planning (COMSENSE) in Novato, CA, which has opposed cell towers. In addition, she is the executive director of the Ad Hoc Association (AHA) of Parties Concerned About the FCC RF Health and Safety Rules, based in Olympia, WA. The AHA has petitioned the federal appeals court in New York City to overturn the FCC's RF/MW radiation exposure limits (see p.18 and *MWN,* N/D97, J/A98 and S/O98).

Although most of the 20 activists at the Fairlee meeting have been involved in mobile phone antenna siting disputes, the new group is "not just concerned with cell towers," said Carole Lomond from her home in Golden, CO, on her return from Vermont. Lomond has been battling a plan to build several digital television (DTV) broadcast towers on Lookout Mountain out-

The Vienna Resolution: Low-Level RF/MW Effects "Established," More Research Needed

In Vienna, Austria, 16 scientists attending the Workshop on Possible Biological and Health Effects of RF Electromagnetic Fields, *October 25-28, adopted the resolution reprinted below. According to Dr. Michael Kundi, the head of the Department of Occupational and Social Hygiene at the University of Vienna's Institute of Environmental Hygiene and an organizer of the workshop, the statement was signed by all those present at the close of the meeting—except Dr. Michael Repacholi, the head of the WHO International EMF Project in Geneva, Switzerland (see p.2). Sponsors of the workshop included the Austrian Society of Hygiene, Microbiology and Preventive Medicine and the Vienna Environmental Bar Association. The program of the workshop and the text of the statement are on the Internet at: <www.irf.univie.ac.at/emf/>. Those who wish to endorse the resolution can do so by completing the form that appears on this Web site. The proceedings of the workshop are scheduled to be published in December.*

Preamble:

The participants agreed that biological effects from low-intensity* exposures are scientifically established. However, the current state of scientific consensus is inadequate to derive reliable exposure standards. The existing evidence demands an increase in research efforts on possible health impacts and on an adequate exposure and dose assessment.

Base stations: How could satisfactory public participation be ensured?

The public should be given timely participation in the process. This should include information on technical and exposure data as well as information on the status of the health debate. Public participation in the decision (limits, siting, etc.) should be enabled.

Cellular phones: How could the situation of users be improved?

Technical data should be made available to users to allow comparison with respect to EMF exposure. In order to promote prudent usage, sufficient information on the health debate should be provided. This procedure should offer opportunities for users to manage reduction in EMF exposure. In addition, this process could stimulate further development of low-intensity emission devices.

Signers:

Drs. Carl Blackman, Environmental Protection Agency, Research Triangle Park, NC, U.S.; Neil Cherry, Lincoln University, Canterbury, New Zealand; Günter Käs, Federal Military University, Munich, Germany; Lebrecht von Klitzing, University of Lübeck, Germany; Wolfgang Kromp, University of Vienna, Austria; Michael Kundi, University of Vienna; Henry Lai, University of Washington, Seattle, U.S.; William Leiss, Queen's University, Kingston, Ontario, Canada; Theodore Litovitz, Catholic University of America, Washington, U.S.; Kjell Hansson Mild, National Institute for Working Life, Umeå, Sweden; Wilhelm Mosgöller, University of Vienna; Joachim Röschke, University of Mainz, Germany; Felix Schinner, University of Vienna; Stanislaw Szmigielski, Center for Radiobiology and Radiation Safety and Military Institute of Hygiene and Epidemiology, Warsaw, Poland; Luc Verschaeve, Flemish Institute for Technological Research (VITO), Mol, Belgium; Ulrich Warnke, University of the Saarland, Saarbrücken, Germany.

**Preferred terminology to use in public communication:*
Instead of using the terms "athermal," "nonthermal" or "microthermal" effects, the term "low-intensity biological effects" is more appropriate.

side of Denver, which is already the site of a dozen high-power radio and TV towers and hundreds of other antennas (see *MWN,* J/A98). Another founding member of the network, Sharon Judge of Sandwich, MA, is working to shut down the U.S. Air Force's PAVE PAWS missile defense radar on Cape Cod (see p.16 and *MWN,* J/F98).

Besides offering information to concerned citizens and advice to activists, Kelley said, the network will press for "credible, impartial science" on the possible health effects of nonionizing electromagnetic radiation. The network will lobby for federally funded research on possible health effects of wireless telephone radiation, to be directed by the Environmental Protection Agency.

The new group will be active in the legislative arena as well: It is urging passage of S.2514, Sen. Patrick Leahy's (D-VT) bill to repeal federal preemption of antenna siting (see *MWN,* S/O98). Aides to Leahy and to Sen. James Jeffords (R-VT) attended the Fairlee meeting as observers.

The network will also argue for a revision of the FCC's RF/MW exposure limits. A statement adopted in Vermont contends that the available scientific evidence "should prompt policymakers to seek more stringent standards immediately."

For more information on the EMR Network, contact Kelley at: 936-B Seventh St., Suite 206, Novato, CA 94945, (415) 892-1863, Fax: (415) 892-3108, E-mail: <info@emrnetwork.org>, Web: <www.emrnetwork.org>.

U.K.'s NRPB Tests Feasibility of Occupational RF/MW Study

U.K. researchers have begun a three-year study of the feasibility of investigating cancer and other health problems among broadcast and telecommunications workers.

A team from the Institute of Occupational Health (IOH) at the University of Birmingham and the National Radiological Protection Board (NRPB) in Chilton, led by IOH's Prof. Malcolm Harrington, will develop a protocol for assessing on-the-job exposures to RF/MW radiation. In its October 30 press release announcing the project, the NRPB noted that the Health and Safety Executive and the Department of Health have affirmed the need for a feasibility study.

The NRPB declined to identify the sponsors of the study, describing them only as "major industrial companies with workforces potentially exposed to RF radiation." Other details were also unavailable, including the types of workers to be examined and the cost of the study. NRPB spokesperson Dr. Michael Clark told *Microwave News* that all this information is confidential.

When the feasibility study is complete, the study team, together with NRPB's Advisory Group on Non-Ionizing Radiation, which is chaired by Sir Richard Doll, will decide whether to proceed with a full-scale epidemiological study.

Corporate Interference Charged over Pacemaker EMI *(continued from p.1)*

Sensormatic maintains that its lawyers' intervention became necessary when McIvor refused to provide the company with all of his raw data. "Sensormatic has never tried to suppress Dr. McIvor's research," insisted spokesperson Lee Pernice. "All we've wanted is the data that he agreed to provide," she told *Microwave News* from the company's headquarters in Boca Raton, FL. "But we never got what we paid for."

McIvor, of the Heart Institute of St. Petersburg in Florida, presented his initial findings at the May 1997 meeting of the North American Society of Pacing and Electrophysiology (NASPE—see *MWN,* S/O97). "When Sensormatic saw an advance copy of the abstract, they wanted me to change the wording," McIvor said in an interview. "I said clinically relevant interactions could be avoided—but Sensormatic wanted me to say that they were not possible."

McIvor wrote up his final results and submitted them to *PACE,* NASPE's journal, in October 1997. The company's stand became more aggressive, he said, after he gave them an advance copy of this manuscript: Sensormatic demanded that he "cease and desist" from saying that there could be any danger to pacemaker users.

By winter's end, McIvor said, he began receiving letters from Sensormatic's lawyers that warned of possible litigation. "After I appeared at a conference in England in March, they insisted that I not speak at any conferences or to the press or make any public comments until the study was published," he stated. McIvor said he made no presentations on his study for the next six months, at the request of his partners at the Heart Institute.

Pernice acknowledged that, "Sensormatic asked Dr. McIvor not to speak publicly on the research until we had the information" that it felt he had promised. The company needed the raw data first, she said, "so that we would be able to respond appropriately to the questions of the media."

On July 6, 1998, *PACE* accepted the study for publication. "But later I got a message from the editor, through his lawyer," said McIvor. "They said, 'We want to make sure that you want to publish—because you might face legal consequences'."

"We did not write to *PACE,"* said Sensormatic's Pernice. She explained that Sensormatic only sent *PACE* copies of letters that Sensormatic's attorneys wrote to McIvor in the dispute over access to the study data. The purpose, she said, "was just to make sure that *PACE* understood that there was controversy around this article."

"My reaction to those events was to get an attorney," said *PACE* editor Dr. Seymour Furman, who is at Montefiore Medical Center in New York City. Furman noted that this was the only time that the journal had ever needed to hire a lawyer. "I believe, frankly, that it was a very wise move," he told *Microwave News.*

According to Pernice, Sensormatic wrote directly to *PACE* only once—to offer a formal release from any legal liability if the journal published McIvor's study. "We were being accused of trying to discourage publication, and we wanted to make clear that we were not," she said, insisting that Sensormatic had never

threatened *PACE* with litigation. Furman responded that, "Legal pressure takes many forms."

At a Food and Drug Administration (FDA) hearing on September 24, the FDA's senior pacemaker reviewer, Mitchell Shein, called McIvor's still-unpublished research "the single most comprehensive study on the issue" (see *MWN,* S/O98). Shortly afterwards, the study appeared in *PACE*'s October issue. "It was a surprise to me," said McIvor, noting that the paper had originally been slated for publication in August. He said he thought that the FDA's interest in the subject had helped to assure publication.

Alongside McIvor's paper, *PACE* ran a sharply critical editorial by Warren Harthorne of Massachusetts General Hospital in Boston. "There are no reports in the real world of patient harm," Harthorne argued, adding that most of the EMI observed by McIvor is "of no clinical relevance."

Harthorne, a past president and founding member of NASPE, is one of many prominent cardiologists who argue that McIvor has exaggerated the significance of his results. He is also a Sensormatic consultant, and has been McIvor's most active critic. At the NASPE annual meeting in May 1998, Harthorne chaired a symposium, funded by an EAS industry group, that highlighted criticism of the McIvor study.

Sensormatic's Pernice argued that it was actually McIvor who was suppressing his research: "What is in that data that he can't share?" she asked. "He clearly told us that we would have access to it. We still haven't seen it."

McIvor responded that he had given Sensormatic substantial data from the study, and made many changes to the paper in response to the company's concerns. The problem, he said, was that the company also wanted its consultants to analyze each patient's electrocardiogram (EKG). "The patients who volunteered for this study had not given permission for their EKGs to be shared with anyone outside of the Heart Institute," McIvor said, and this had made it difficult to respond to Sensormatic's requests.

Sensormatic Long Under Siege

The conflicts over McIvor's study occurred against the background of a bitter struggle that has engulfed Sensormatic for several years—a struggle in which pacemaker EMI has played a prominent role. The company has been under attack by Wall Street speculators known as "short-sellers," who bet that the price of Sensormatic's stock will fall. The short-sellers have done their best to make this prediction come true, by spreading bad news and rumors about the company at every opportunity.

In both 1994 and 1995, short-sellers tried to use news stories about EAS systems and pacemakers against Sensormatic. In response, the company hired Harthorne to review confidential data from an industry-supported test facility. Harthorne reported that there was no cause for pacemaker users to worry.

When Sensormatic's top public relations consultant left in 1994, he cited the company's secrecy over EMI data. He promptly went to work for a competitor, Checkpoint Systems Inc. of Thorofare, NJ, and met with short-sellers. Checkpoint contends that it has a safer product, and has aggressively promoted this message to the media.

"The EAS industry is one of the most poisonous industries I've seen," commented Prof. Joshua Bamfield, director of the Center for Retail Research in Nottingham, U.K. Bamfield was the main organizer of a March 1998 conference at which McIvor was a featured speaker. Bamfield told *Microwave News* that he was pressured to drop McIvor from the program. "It was suggested to me that McIvor was just a public relations front, and that I ought to have another speaker," he said. Bamfield declined to give further details, but noted that he had felt compelled to buy "an incredibly large professional indemnity policy."

The March conference was attended by a Sensormatic lawyer, Kenneth Taber of Christy & Viener in New York City—the same lawyer who later wrote to McIvor to demand that he not speak in public and forwarded the correspondence to *PACE*.

Sensormatic has recently sought to portray McIvor as a tool of Checkpoint. On November 4, a company press release described McIvor as "author of a study principally funded by a competitor of Sensormatic"—namely, Checkpoint. The fact that Sensormatic helped to fund the study went unmentioned.

Sensormatic has supported other studies of pacemaker EMI in France, Spain, the U.K. and the U.S. But the company reportedly blocked one attempt to document the problem. George Eisinger and Dan Costello, both with pacemaker manufacturer St. Jude Medical, told *Microwave News* that in mid-July Sensormatic refused to allow testing of a Seattle department store employee who had reported symptoms of pacemaker EMI. Costello said that the store and Sensormatic both said no to the proposed test. "This is the only time I've run into a manufacturer that wouldn't allow me to test," commented Eisinger, a clinical engineer.

"That's incorrect," said Sensormatic's Pernice, denying that the company had blocked such testing. "Sensormatic would not have the authority to deny testing at a retail location," she said. "Once the systems are sold they are no longer our property, and the stores are free to do whatever they want."

Two New EMI Case Reports

"A life-threatening interaction" between an implantable cardiac defibrillator (ICD) and an anti-theft system is reported in the November 5 issue of the *New England Journal of Medicine (339,* pp.1,371-1,374).

Dr. Peter Santucci and colleagues at Rush-Presbyterian-St. Luke's Medical Center in Chicago describe a 72-year-old man who received four shocks from his defibrillator while standing at a magazine rack, about one foot from an acousto-magnetic anti-theft system.

"If nobody had pulled him away, there's a good chance he might have died right there," Santucci told *Microwave News:* "When the EMI occurred, the man had no heartbeat," since he is dependent on pacing from his ICD.

But Santucci noted that such severe EMI is rare, and can be avoided if ICD users do not linger near anti-theft systems. "If people are aware, it shouldn't cause major problems," he said.

A letter in the same issue of the *Journal* (pp.1,394-1,395) by Dr. S. Sridhar of Affiliated Cardiologists in Phoenix and Dr. Michael McIvor describes how EMI from acousto-magnetic systems caused "palpitations, nausea...and dizziness" in a pacemaker patient of Dr. Sridhar's.

« Power Line Talk »

The staff at the **NIEHS** in Research Triangle Park, NC, has nearly completed a draft of Director Dr. **Kenneth Olden**'s report to Congress on the **EMF RAPID** program. It is now undergoing various reviews. No word yet on when it will be released to the public. More than 2,000 copies of the Working Group's report have now been distributed (see *MWN,* J/A98). The transcripts of the four hearings, at which the public was invited to comment on the report, have been added to the NIEHS Web site: <www.niehs.nih.gov/emfrapid>. The 178 sets of written comments on the report, running over 2,000 pages, have been collected into four bound volumes. Copies are being placed in a number of libraries, including those of the National Academy of Sciences and the Edison Electric Institute, both in Washington, EPRI in Palo Alto, CA, and the WHO EMF project in Geneva, Switzerland. The EMR Network has also been given a set (see also p.5). "We plan to put all the written public comments on the Web early next year," said NIEHS' Dr. **Mary Wolfe**.

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The **American Institute of Stress** will honor Dr. **Ross Adey** at its 10th annual meeting, to be held in Montreux, Switzerland, the first week of March (see p.15 for details). Adey will receive the 1999 **Hans Selye Award** for his "seminal contributions" to the understanding of biological effects resulting from exposure to weak EMFs.

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The Labor government of **U.K.** Prime Minister **Tony Blair** has rejected a request for a moratorium on the construction of new transmission lines. In an October 29 debate in the House of Commons, **Anne McIntosh**, a Conservative member from northern England, asked that no new power lines be built "until more is known about their health effects and potential risks." McIntosh is concerned about a planned 400 kV line that would run through her district. The government approved the power line last March, after extended public inquiries. Responding to McIntosh, **Tessa Jowell**, Blair's minister for public health, reaffirmed the conclusion reached by Tory Prime Minister **John Major**'s government in 1995: "Possible health effects provide insufficient grounds" to block the line. McIntosh countered that the government banned beef on the bone to protect the public from BSE ("mad cow disease") despite the lack of conclusive evidence of a hazard to human health, and she argued that it should authorize similar preventive measures for EMFs.

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A consortium of New York state utilities is the latest to fold its EMF research operation. "Our EMF work is coming to an end as of December 31," said **Ed Torrero**, the EMF project manager of the Empire State Electric Energy Research Corp. (**ESEERCO**) in New York City. The decision to end EMF work is part of an overall cutback at ESEERCO, prompted by "changes in the utility industry, specifically deregulation," according to **Herbert Kaufman**, director of R&D operations. ESEERCO has one ongoing EMF project: an assessment of magnetic field exposures from transmission lines of 345 kV and above. This project will be taken over by the **New York Power Authority** (NYPA), where it will be managed by Dr. Susan White of the NYPA's White Plains office. ESEERCO recently completed its part of a joint study with the EPRI in Palo Alto, CA, on whether wire codes are associated with measured magnetic fields. Despite deregulation, the New York State Public Service Commission's (PSC) 1988 ruling ordering utility industry funding of EMF research (see *MWN,* M/A88) is still in effect—but it is not clear who will do any future studies. The state wants EMF research to continue, Dr. **Dan Driscoll** of the PSC staff in Albany told *Microwave News*. The PSC wants to see field characterization and exposure assessment studies for lower voltage power lines, in addition to the ongoing exposure assessment effort, which Driscoll called "the major EMF project in New York." But while Driscoll said that it is his understanding that the utilities will do the work themselves, he conceded that he is not aware of any plan that is now in place. He also noted that the PSC could change its views on EMF research. When the NIEHS releases its final report on the EMF RAPID program (see *MWN,* S/O98), a New York staff committee on EMFs, which Driscoll chairs, will review it together with the NIEHS Working Group's report (see *MWN,* J/A98) and submit recommendations to the PSC. If the NIEHS says there is no health risk from EMFs, he explained, the PSC may decide that further studies are unnecessary.

NIOSH Measurement Manual

The National Institute for Occupational Safety and Health (NIOSH) has published a technical manual on how to measure EMFs below 30 kHz in work environments.

Designed to assist industrial hygienists and researchers, the manual describes 16 methods that have been used to measure EMF exposures in epidemiological studies and health hazard evaluations. It also includes suggestions on how to develop protocols to meet other needs.

The manual, which comes in a loose-leaf binder, was edited by Drs. Joseph Bowman of NIOSH in Cincinnati, Michael Kelsh of E^{x}ponent in Menlo Park, CA, and William Kaune of EM Factors in Richland, WA.

Manual for Measuring Occupational Electric and Magnetic Field Exposures, DHHS (NIOSH) Publication No.98-154, 1998, can be ordered from NIOSH publications at: (800) 356-4674 or by E-mail at: <pubstaft@cdc.gov>. Copies are scheduled to be available in early 1999.

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The **"Less EMF" catalog** contains products such as gaussmeters and low-field appliances, and books that range from *The Great Power Line Cover-Up* to the NAS EMF report. A section titled "Metaphysical Items" includes exotic devices whose efficacy might generously be described as unproven, such as the "D-Nuke Microwave Neutralizer" and the "Electrosmog Corrector." For a catalog, call (888) 537-7363, or go to <www.lessemf.com> on the Web.

Four Labs Link 50/60 Hz Fields to DNA Breaks; Two Reproduce Effect at Occupational Exposure Levels

Power frequency EMFs have been found to increase significantly the number of broken strands of DNA in recent experiments in India, Sweden and the U.S. The effect has now been reported by four different labs, with consistent and statistically strong results.

In two recent experiments, the increase in DNA damage was seen after exposure to fields of 75 mG and 100 mG—levels that are routinely found in the workplace. The effect appears to be cumulative, in one case first emerging after a month's exposure.

Drs. Henry Lai and Narendra Singh of the University of Washington, Seattle, were the first to report an increase in DNA breaks after exposure to 60 Hz fields. They found more single-strand breaks in the brains of rats after a single two-hour exposure at 1 G, 2.5 G or 5 G, and more double-strand breaks at 2.5 G and 5 G. The increases are dose-dependent, and all are highly significant ($p<0.001$). These results were published last year in *Bioelectromagnetics (18,* pp.156-165, 1997; see also *MWN,* N/D95).

Even earlier, Lai and Singh had reported that microwave exposure caused an increase in DNA breaks in the brains of rats (see *MWN,* N/D94). They went on to study exposure to 60 Hz fields, and have followed up their initial EMF study with a series of related experiments.

An increase in DNA breaks after exposure to 60 Hz fields was subsequently observed by Dr. Jerry Phillips of the Veterans Administration Medical Center in Loma Linda, CA, using a 1 G field, and at much higher 50 Hz EMF levels by Dr. Yog Raj Ahuja of the Mahavir Medical Research Center in Hyderabad, India.

Sweden's Dr. Britt-Marie Svedenstål has observed the same effect in a study using real-world EMFs, at levels that occur in many jobs—an average field strength of 75 mG. In Svedenstål's study, mice were exposed outdoors to the fields from a 220 kV power transmission line for 11, 20 or 32 days. After 11 or 20 days there was virtually no difference between the EMF-exposed animals and controls—but after 32 days the exposed animals had a highly significant increase in DNA damage.

"Something is happening," Svedenstål told *Microwave News.* "There is a weak genotoxic effect." Svedenstål, who is in the Department of Radioecology at the Swedish University of Agricultural Sciences in Uppsala, presented her findings at the final EMF research review sponsored by the U.S. Department of Energy (DOE) in Tucson, AZ, in September (see *MWN,* S/O98). She called the results "a signal to go further."

Like the Svedenstål study, Lai and Singh's latest work also showed that DNA damage can occur at lower EMF levels. After exposing rats to a 100 mG, 60 Hz field for 24 hours, Lai and Singh found significant increases in both single- and double-strand breaks in DNA from the animals' brains. After 48 hours, there was a further increase. This suggests that the effect is cumulative, Lai told *Microwave News*—which would be consistent with Svedenstål's results.

Svedenstål's team included Drs. Karl-Johan Johanson, Mats-Olof Mattsson and Lars-Erik Paulson. Johanson, also of the Swedish University of Agricultural Sciences, was one of the originators of the comet assay, a test for detecting DNA damage in which broken strands form a comet-like tail. Johanson's version of the assay, used in the Svedenstål study, is chemically neutral. Singh developed another version of this technique, the alkaline comet assay, which was used in the Lai-Singh, Ahuja and Phillips experiments.

At the other end of the intensity scale, Ahuja and colleagues used field levels that were extremely high, ranging from 20 G to 100 G. This also produced significant effects—after only one hour of exposure—in blood samples from six human volunteers.

"At each of the magnetic field intensities tested by us, there was a significant increase in the DNA damage as compared to the control," Ahuja's group told the *International Conference on Electromagnetic Interference and Compatibility,* held in Hyderabad in December 1997. This "increase in genomic instability," they suggested, could mean that chronic exposure to very strong EMFs "may result in an increased incidence of congenital malformations and cancer."

Phillips told *Microwave News* that he saw significant increases in DNA breaks in eight out of ten experiments he conducted with Molt-4 T-lymphoblastoid cells, a type of human leukemia cell. Phillips exposed the cells to a 1 G field for 18 hours.

In related experiments, Phillips and colleagues first treated similar cells with a chemical known to cause DNA damage. Cells that were then exposed to EMFs showed significantly more damage, as well as changes in the activity of an enzyme involved in DNA repair, poly(ADP-ribose) polymerase.

"We propose that [EMF] exposure can affect both DNA damage and repair processes," Phillips stated at the DOE meeting in Tucson, "and that it can act in concert with chemical agents to potentiate the damaging effects of those agents." There was also a decrease in the number of viable cells, and Phillips suggested

Funding Dries Up for DNA–EMF Studies

While recent studies of DNA damage and 50/60 Hz fields are provocative, consistent and statistically strong, the prospects for follow-up research appear dim.

Lai and Singh's work in this area was funded by the NIEHS EMF RAPID program, which is now coming to an end. Phillips's work was funded by DOE's EMF research program, which Congress shut down this fall (see *MWN,* S/O98). And Svedenstål's department will be closed at the end of the year.

In an interview, Lai said he had asked EPRI to fund studies of power frequency EMFs and DNA damage. "We sent in a complete proposal, and the reviewers recommended funding," said Lai. "Dr. Charles Rafferty wrote to us two-and-a-half years ago and said EPRI wanted to go ahead. But we have never received a dime."

that EMF exposure may "increase the number of cells that undergo apoptosis," or programmed cell death.

In an interview, Phillips said that his findings on DNA damage might support studies that have linked EMF exposure to chromosome damage—for which DNA damage is a prerequisite (see *MWN,* Mar83, J/F85 and S/O88). "Our work confirms the damage to DNA observed by others," he stated, "and emphasizes the need to use the most sensitive assay available."

In Lai and Singh's recent work, they have found that the ability of EMFs to increase DNA damage can be blocked in several different ways. Their findings suggest that the mechanism for this EMF effect involves free radicals—compounds that are highly reactive, and therefore able to do biological harm.

Free radicals can be kept from damaging other cells by antioxidants, such as melatonin or Trolox, a Vitamin E analog. Lai and Singh have found that treatment with Trolox, which they describe as "a potent free radical scavenger," prevented EMF-induced breaks in DNA. These results were reported at the 1997 DOE EMF research review in San Diego.

The University of Washington researchers had previously achieved the same result by using two different antioxidants (see *Journal of Pineal Research, 22,* pp.152-162, 1997). In addition, Lai told *Microwave News,* they have found that this EMF effect can also be blocked by 7-nitroindazole—a chemical that suppresses the production of nitric oxide, a common free radical.

Lai and Singh attribute the buildup of DNA damage observed in these experiments to a combination of "oxidative damage to DNA and its subsequent misrepair." They speculate that EMF-induced free radicals may not only lead to an increase in DNA breaks, but also to an increase in cell death. If so, this would explain how EMFs could play a role in the development of neurodegenerative illnesses such as Alzheimer's disease and ALS.

WHO EMF Project Eschews Prudent Avoidance

The World Health Organization's (WHO) EMF Project does not endorse prudent avoidance. "It is not WHO's job to be recommending 'prudent avoidance' to national governments," Dr. Michael Repacholi, WHO's project manager, told *Microwave News*. He stressed that the WHO has no position on the issue.

In its latest fact sheet, *EMFs and Public Health: Extremely Low Frequency (ELF),* issued in November, the WHO project advises that, "[T]here is no need for any specific protective measures for members of the general public."

Repacholi argued that this recommendation followed from a seminar on EMFs and health held in Bologna, Italy, in June 1997 (see *MWN,* M/A97). Attendees there concluded that while the literature does not establish that low-level exposures cause health hazards, biological effects have been observed. A summary of the Bologna meeting has been accepted for publication in *Bioelectromagnetics* and is scheduled to appear next year.

Repacholi explained that the WHO program is designed to determine if there are EMF health effects. He added that, "If national authorities want to take this [uncertainty] to mean they need to act in case there are any health consequences found in the future, then that is their responsibility."

Meanwhile, on November 17, the WHO project launched an initiative to "harmonize" EMF exposure standards worldwide. "Globalization of trade and the rapid introduction of mobile telecommunications worldwide have focused attention on the large differences...in standards limiting exposure to EMFs," the WHO press release noted.

Bullock Case Ends: An EMF Era Comes to a Close? *(continued from p.1)*

Watson of Watson & Renner in Washington in an interview. "I have felt all along that these cases cannot prevail if they are not grounded in solid scientific evidence." Watson is the attorney for the Utility Health Sciences Group, a consortium of electric utilities dealing with EMF issues.

"These cases will resurface as the science continues to develop," predicted Bruce DeBoskey of Silver & DeBoskey in Denver, who represented Nancy Jordan in her unsuccessful cancer suit against Georgia Power Co. "I think this is sort of a half-time in the life of EMF–cancer litigation," DeBoskey said. "In the years ahead, there will be another attempt to put together the case for causation—but I think that now is not the time."

In late 1995, famed trial lawyer Joseph Jamail dropped a lawsuit involving nine children with leukemia after Texas courts adopted more restrictive standards for scientific evidence (see *MWN,* S/O95). Two test cases in Britain were dropped in 1997, with attorneys also citing the need for more clear-cut scientific data (see *MWN,* S/O97). The Bullock lawsuit was the last well-known EMF–cancer case in the U.S., although a source familiar with U.S. EMF litigation told *Microwave News* that another had been or soon would be filed. No details were available at press time.

Melissa Bullock was diagnosed with brain cancer in 1989 at the age of 17, and the lawsuit was filed two years later (see *MWN,* J/F92). In a statement announcing the withdrawal of the suit, she emphasized that, "The lawsuit was brought because we believed then, as we do now, that EMFs caused my brain tumor and changed my life." Her mother, Suzanne, noted that at the time the suit was filed, several studies linked brain cancer and EMF exposure. "We had hoped that over the years even more compelling scientific proof would develop," Suzanne Bullock explained. "It has not and so we are left with no other choice but to withdraw this case."

Anthony Fitzgerald, a lawyer for Northeast Utilities who is with Carmody & Torrance in New Haven, said, "There's simply no scientific basis on which one could say that EMFs would lead to development of a brain tumor." In an interview, Fitzgerald said that the company's seven expert witnesses on EMFs and brain tumors included "internationally prominent researchers."

Northeast Utilities planned to submit videotaped testimony from the U.K.'s Sir Richard Doll, described by the utility as "the world's foremost epidemiologist." Doll, who drew world atten-

tion to the link between tobacco and lung cancer in the 1950s, has been reluctant to draw firm conclusions about cancer and EMFs (see *MWN,* M/A94, S/O96 and S/O97).

According to court papers, several of the utility's experts drew distinctions between the data on brain tumors versus other cancers, as well as between occupational and residential exposures.

One example is Dr. Lennart Hardell, an oncologist at the Örebro Medical Center in Örebro, Sweden. Hardell led a 1995 review of EMF health effects, which was part of the basis for the Swedish government's decision to endorse a policy of prudent avoidance (see *MWN,* N/D95). Hardell's review found possible associations between residential EMF exposure and childhood leukemia, and between occupational exposure and chronic lymphatic leukemia (CLL). But he found no evidence of an increased risk of brain cancer from residential exposure and no "consistent pattern" of risk from EMFs at work. Fitzgerald said that if the case had gone to trial, it would have been the first time that Hardell appeared as a witness in any EMF case.

Last June, the EMF working group assembled by the National Institute of Environmental Health Sciences (NIEHS) came to very similar conclusions (see *MWN,* J/A98). A majority of the panel saw the data on childhood leukemia and on CLL among workers as indicating that EMFs are "possible human carcinogens." But the working group voted overwhelmingly that the evidence for any EMF–brain tumor connection must be considered "inadequate."

Other Northeast Utilities witnesses included Dr. John Moulder of the Medical College of Wisconsin in Milwaukee, an associate editor of *Radiation Research,* and Dr. Jerry Williams of Johns Hopkins University in Baltimore, who served on both the National Research Council and NIEHS panels on EMF health risks (see *MWN,* N/D96 and J/A98). According to court papers, Williams was expected to testify that residential EMF exposure is not "a substantial factor in producing brain cancer," while Moulder planned to say that residential exposure does not "produc[e] cancer of any kind." Moulder has previously testified on behalf of utilities in EMF cases; Williams is a longtime member of EPRI's EMF Advisory Committee.

Expert witnesses for the plaintiffs were to include Drs. Stephen Cleary of the Medical College of Virginia in Richmond, Reba Goodman of Columbia University in New York City and David Ozonoff of Boston University. Of these, only Ozonoff, an epidemiologist, was described as prepared to testify that EMFs "were a substantial factor in causing Melissa Bullock's cancer." Cleary, a biophysicist, was expected to say only "that 60 Hz magnetic fields are biologically active." Goodman was to describe "cellular changes" that can be caused by EMFs, changes that could contribute to the development of cancer.

"The association between EMFs and brain tumors continues to appear in the literature, but it hasn't gotten stronger," explained Horwitz, the Bullocks' lawyer. "So the doctors who'd been called to testify were increasingly uncomfortable testifying that EMFs are causative, and causative in this particular case."

"I think there needs to be a clearer understanding of the mechanism" for EMF–cancer lawsuits to be won in the future, Horwitz said. It need not be definitively proven, he added, but should stand out from alternatives. "Once you have a good hypothetical mechanism," he noted, "you can refine the epidemiological studies and should start to see some higher risk ratios."

The Bullocks' case became well known after it was featured in Paul Brodeur's 1990 article in the *New Yorker,* "Calamity on Meadow Street," a continuation of his "Annals of Radiation" series. Brodeur detailed four cases of brain cancer on the one-block street, including Melissa Bullock's. Brodeur's second book on EMFs, *The Great Power Line Cover-Up,* published in 1993, begins with the Meadow Street story.

Another Meadow Street resident, Jack Walston, had filed suit a month after the Bullocks. But Walston's nonmalignant brain cancer had been diagnosed in 1979, and his case was dismissed on the grounds that he had waited too long to begin legal action.

"Because of my illness I will never be independent, I will not go to college or have a good job," said Melissa Bullock in her statement. "What I hoped to accomplish in this lawsuit was to prevent other children from getting sick from EMFs and suffering the way my family and I have." Horwitz explained that although Bullock has made progress since her tumor was removed, she is still able to read at only a second-grade level.

Bruno Ranniello, a spokesperson for Northeast Utilities, told *Microwave News,* "We've said from the outset that we believe the power lines and the nearby substation had nothing to do with Melissa's cancer." He added that, "We sympathize with the Bullocks—Melissa's cancer is a tragedy."

Suzanne Bullock's statement emphasized the need to continue research: "We hope that our withdrawal of this lawsuit will not deter honest scientists from continuing their investigation...[of] the dangers of EMFs."

National EMF Advisory Group Urges Continued Research

The National EMF Advisory Committee (NEMFAC) has strongly urged the National Institute of Environmental Health Sciences (NIEHS) to continue EMF research.

In an October 20 letter signed by NEMFAC Chair Shirley Linde, the committee told NIEHS Director Dr. Kenneth Olden that, "Without further EMF research, public confusion, speculation and controversy about the public health impact of EMFs will persist and formulation of a clear and consistent set of exposure guidelines will be delayed."

"It is also imperative that there is sufficient stability of funding to ensure the maintenance of a viable infrastructure of scientists and their laboratories over the long term," NEMFAC stated.

The committee asked Olden to ensure that the public is informed about potential health risks and about "low- and no-cost options for minimizing personal exposure to EMFs for those individuals who choose to exercise these options" (see *MWN,* S/O98).

NEMFAC was mandated by the U.S. Congress to advise the heads of the NIEHS and the Department of Energy on the implementation of the EMF RAPID program. Olden is preparing a final report on the EMF RAPID program for submission to Congress (see p.8).

Behind the Scenes at the NIEHS EMF Working Group Meeting: Germany's Dr. Wolfgang Löscher Cites Dirty Tricks

One of the most contentious issues at two recent meetings sponsored by the National Institute of Environmental Health Sciences (NIEHS)—the Phoenix in vivo *science review symposium in April and the Minneapolis Working Group meeting in June—was how to reconcile the divergent results of EMF–breast cancer animal studies.*

Dr. Wolfgang Löscher's lab at the School of Veterinary Medicine in Hannover, Germany, has reported an EMF-induced increase in tumor growth among rats, while Dr. Larry Anderson at the Battelle Pacific Northwest Labs in Richland, WA, did not see this effect (see MWN, *M/A98 and M/J98).*

Two of the strongest voices to discount Löscher's findings were those of Drs. Gary Boorman of the NIEHS and Jerry Williams of Johns Hopkins University. For instance, Williams drafted a minority statement to the Working Group report which argued that the Löscher studies are "fundamentally flawed."

One of the complications in interpreting the Battelle results was that in two of the three experiments, the tumor rates among the control animals induced by the chemical carcinogen DMBA were so high (92%-96%) that there was little room for any contrast with those among the EMF-exposed rats. While Anderson himself felt uncomfortable drawing any conclusions on these two studies, Boorman and NIEHS' Dr. Christopher Portier have argued that they, together with the third Battelle study, yielded enough information on tumor incidence and growth to give them confidence that the German studies had been refuted.

The letter reprinted below was obtained by Microwave News *from the NIEHS under the Freedom of Information Act.* Microwave News *offered Boorman an opportunity to respond, but he declined, other than to write that, "The letter [from Prof. Ulrich Mohr] was shown to Dr. Michael Gallo and he determined that it was not relevant to the committee. It was not shown to others!"*

In an August 28 letter to Löscher, Dr. George Lucier, director of the NIEHS Environmental Toxicology Program, apologized and assured him that the Mohr letter had had no impact on any of the NIEHS committees reviewing the EMF–animal studies.

August 18, 1998

Dear Dr. Boorman:

As you know, my group has performed a series of experimental *in vivo* studies on the potential carcinogenic effects of 50 Hz electromagnetic field (EMF) exposure in the DMBA breast cancer model in rats. Part of these studies was supported by the U.S. Department of Energy (DOE), Office of Utility Technologies, through Oak Ridge National Laboratory. Our data have been published in several papers in international peer-reviewed cancer journals. Because our studies are among the first to demonstrate a cocarcinogenic effect of EMF exposure in a widely used cancer model, our papers are highly cited. Our data were the reason for a replication study within the National Toxicology Program of the NIH/NIEHS (NIH Publication No. 98-3979). Furthermore, I was invited several times by the DOE, the NIH, or the NIEHS to report on our data or to act as an expert during meetings in the U.S., including the recent EMF Science Review Symposium in Phoenix. I was also invited by the NIEHS to join the working group of scientists which met in Brooklyn Park [outside] Minneapolis and to help in preparing the working group report *(Assessment of Health Effects from Exposure to Power Line Frequency Electric and Magnetic Fields)* of the NIH/NIEHS, but I could not attend the meeting because of duties here in Germany.

I shortly informed you by e-mail of August 2, 1998, that I heard from scientists who attended the Phoenix and Minneapolis meetings that you cited during the meetings from a letter of Prof. Ulrich Mohr, Hannover, Germany. Mohr, who is a well-known pathologist, and his group cooperated with us during some of our studies, including a study that was published in *Carcinogenesis* (Baum, Mevissen, Kamino, Mohr and Löscher, "A Histopathological Study on Alterations in DMBA-Induced Mammary Carcinogenesis in Rats with 50 Hz, 100 ∝T Magnetic Field Exposure," *Carcinogenesis 16,* pp.119-125, 1995). In this study, we reported in EMF-exposed rats a significant increase in incidence of grossly recorded mammary tumors, a significant increase in size of grossly recorded mammary tumors and a significant increase in incidence of adenocarcinomas, whereas the overall incidence of mammary tumors (including those only detectable at the microscopic level) was not changed significantly compared to sham controls. In his letter to you of March 3, 1998, Mohr claims that he thinks the study is negative and that he has not seen the paper until recently. Furthermore, he claims that, "Prof. Löscher has used our name, of which I was not actually aware." He also states that by recalculation of the data, using a two-sided Fisher's exact test, the increase in adenocarcinomas in the EMF group is not statistically significant.

I have letters from Dr. A. Baum (the first author of the paper and coworker of Prof. Mohr during the time of the study) clearly indicating that Mohr's group wrote the first draft of the paper, Mohr's group did the statistical analysis of the histopathological findings, including the significant increase in adenocarcinomas and Mohr saw the manuscript before it was submitted for publication in 1994. Of course, I sent Mohr the final manuscript before submission and a reprint of the paper after publication in 1995.

I asked Mohr why he wrote this letter to you, including untrue statements. He wrote me by letter of August 7 that his letter to you was a private letter (not thought to be used in public), and that the fact that he was not aware of the publication, and who did what, could only be due to a striking "communication deficit" in his institute at the time of the study.

How could you use such a letter during the meeting in Minneapolis? I got the letter only after the meeting without having a chance to comment upon its contents. The use of this letter with its false statements is suited to discredit me and my group. After my former coworker Dr. Meike Mevissen heard of the letter and its use during the Minneapolis meeting, she wrote you and asked for a copy, which was the way how I received it. In your e-mail answer of August 3 to my e-mail of August 2, you wrote: "In the meeting in Phoenix, copies of the letter were not given to the participants. Similarly in Brooklyn Park, the chairperson, Dr. Mike Gallo, felt that this letter would be inappropriate for distribution, so it was not given to the participants. Dr. Mike Gallo read the letter but was not given a copy." The fact that you asked Dr. Gallo to distribute the letter speaks [for] itself. Furthermore, as mentioned above, I heard from several U.S. scientists that you mentioned the letter during the Phoenix and Minneapolis meetings and used its contents to discredit my group and the results of our studies.

I am very disappointed about this matter! I never had such an experience in the almost 25 years of my scientific life. It would have been fair to inform me about this letter from Prof. Mohr of March 3. There are several witnesses (Baum and Kamino of Mohr's group, Mevissen of my group) who could confirm that Mohr was aware of the publication, allowed his coworkers to publish it and was also aware that the statistics were done in his institute. As mentioned, there are also letters [from] Mohr's group proving this.

During the meeting in Phoenix, after a debate of two days on EMFs and experimental breast cancer studies, including my data, you stated that I behaved "like a gentleman" during this debate. Dr. Boorman, your behavior is certainly not "gentleman-like." In my e-mail of August 2 to you, I stated that if the discredit of my group produced by your use of this letter [is not] minimized by [giving] correct information [to] everybody [to] whom you gave false information, I will inform the Bioelectromagnetics Society (BEMS) about the matter and ask for correction. Furthermore, I will not accept any invitations to meetings of the NIEHS or NIH in the future (I just got such an invitation from the NIH to an EMF meeting a couple of days ago) until this matter is resolved in an acceptable manner.

Yours sincerely,
Dr. Wolfgang Löscher

Hot New Papers

Gabriele Freude et al., "Effects of Microwaves Emitted by Cellular Phones on Human Slow Brain Potentials," ***Bioelectromagnetics, 19,*** **pp.384-387, 1998.**

"In conclusion, EMFs with a radiation intensity of a usual GSM telephone call may alter preparatory bioelectrical brain activity. Interestingly, the effects occur with respect to the particular task and brain topography. Because the mechanisms of EMF influences on central nervous information processing are rather unknown, the discussion remains on a rather speculative level."

Howard Bassen, Hans Moore and Paul Ruggera, "Cellular Phone Interference Testing of Implantable Cardiac Defibrillators [ICDs] ***in Vitro," Pacing and Clinical Electrophysiology, 21,*** **pp.1,709-1,715, September 1998.**

"Three models of ICDs were subjected to EMI susceptibility testing using two types of digital phones and one analog cellular phone, each operating at their respective maximum output power. EMI was observed in varying degrees from all DCPs [digital cellular phones]. Inhibition of pacer output occurred in one ICD, and high voltage firing occurred in the two other ICDs, when a TDMA 11 Hz DCP was placed within 2.3 cm of the ICD....EMI occurred most frequently when the lower portion of the monopole antenna of the cellular phone was placed over the ICD header....Amplitude modulation is usually the most significant parameter affecting the ability of a source of RF fields to induce interference....If the amplitude modulation has frequency components in the physiological passband of the medical device, significant interference occurs."

Timo Partonen and Jouko Lönnqvist, "Seasonal Affective Disorder" (seminar), ***The Lancet, 352,*** **pp.1,369-1,374, October 24, 1998.**

"SAD was at first believed to be related to abnormal melatonin metabolism, but later findings did not support this hypothesis. Studies of brain serotonin function support the hypothesis of disturbed activity."

Microwaves To Detect Breast Cancer

Susan Hagness, Allen Taflove and Jack Bridges, "Two-Dimensional FDTD Analysis of a Pulsed Microwave Confocal System for Breast Cancer Detection: Fixed-Focus and Antenna-Array Sensors," ***IEEE Transactions on Biomedical Engineering, 45,*** **pp.1,470-1,479, December 1998.**

"The system exploits breast-tissue physical properties unique to the microwave spectrum, namely, the translucent nature of normal breast tissues (without lesions) and the high dielectric contrast between malignant tumors and the surrounding normal breast tissues....[O]ur simulations showed that malignant tumors as small as 2 mm in diameter can be detected in the presence of the background clutter generated by the heterogeneity."

First Cell Phone-Headache Study Out

Bruce Hocking, "Preliminary Report: Symptoms Associated with Mobile Phone Use," ***Occupational Medicine, 48,*** **pp.357-360, August 1998.**

"Forty respondents from diverse occupations described unpleasant sensations such as a burning feeling or a dull ache mainly occurring in the temporal, occipital or auricular areas. The symptoms often began minutes after beginning a call, but could come on later during the day. The symptoms usually ceased within an hour after the call, but could last until evening. Symptoms did not occur when using an ordinary handset, and were different from ordinary headaches. There were several reports suggestive of intracranial effects....75% of cases were associated with digital mobile phones." (See *MWN,* M/J97 and M/J98.)

James Knoke, Gregory Gray and Frank Garland, "Testicular Cancer and Persian Gulf War Service," ***Epidemiology, 9,*** **pp.648-653, November 1998.**

"The finding in our population that blacks had less than 20% the risk of developing testicular cancer as whites is consistent with the published literature, as is the finding that men between the ages of 22 and 31 years were at greater risk than those who were younger or older. However, the increased risk for electronic equipment repair personnel (risk ratio=1.56; 95% confidence interval=1.23-2.00) has not been confirmed by other published reports."

Juris Galvanovskis and John Sandblom, "Amplification of Electromagnetic Signals by Ion Channels," ***Biophysical Journal, 73,*** **pp.3,056-3,065, December 1997.**

"[W]e have focused in this study on the primary mechanisms that a biological cell can use to amplify weak external influences, for instance, an alternating magnetic field. Such amplification mechanisms have tended to be overlooked in attempts to explain the response of cells exposed to electromagnetic fields. We have shown that a system of identical ion channels embedded in a membrane and synchronously modulated can significantly amplify the original signal."

J. Dobson and T.G. St. Pierre, "Thermal Effects of Microwave Radiation on Biogenic Magnetite Particles and Circuits: Theoretical Evaluation of Cellular Phone Safety Aspects," ***Electro- and Magnetobiology, 17,*** **pp.351-359, 1998.**

"Calculations based on particle size, electrical conductivity of magnetite and power output from cellular telephones indicate that local heating of submicron magnetite particles is insignificant in comparison with thermal background effects at present power output levels and magnetite concentrations."

Clippings from All Over

"We have seen a dramatic increase in people claiming health problems from mobiles coming to us. We now have more than 20 cases, including six brain tumors, five with immune system problems and a number of severe migraine sufferers. There is no question in my mind that the evidence is mounting up and I understand we should have the results of some significant new studies in the near future. I am hopeful we will be in a position to launch proceedings in about six months."

—Martyn Day, attorney, Leigh, Day & Co., London (U.K.), quoted by Nic Fleming and Michael Hanlon in "Cellphone Firms Face Deluge of Claims in Health Alert," *The Express* (U.K.), p.8, October 16, 1998

[T]he popular press tends to put a sensational spin on the idea that cell phones contribute to brain cancer, and anecdotal reports of headaches, skin numbing, and memory loss due to cell phone use have helped to heighten public fears. Science and industry alike are looking to the IARC study to provide a firm foundation for either assuaging public fears or enacting measures to protect against whatever health risks may come to light.

—"Of Mobile Phones and Morbidity," *Environmental Health Perspectives* (published by the NIEHS), *106,* pp.A474-A475, October 1998 (see *MWN,* S/O98)

"If Motorola and Lucent want to do research, more power to them. If it doesn't help post-market surveillance, then it doesn't help the public."

—Dr. George Carlo, chair, Wireless Technology Research (WTR), Washington, quoted by Jeffrey Silva in "WTR To Recommend Post-Market Surveillance in Cancer Debate," *RCR,* p.3, November 2, 1998

[BellSouth Mobility Georgia Director of Engineering Terry] Durand says BellSouth has disguised antennas for in-building situations as well. For some classrooms, the carrier has installed antennas that look like smoke detectors.

—Heather Bainbridge, associate editor, in "Towers for the Community," *Wireless Business & Technology,* p.45, November 1998

"High-powered microwaves are obviously the weapons of choice."

—Bengt Anderberg, director general, Swedish Defense Research Establishment (a counterpart of U.S. DARPA), quoted by Bruce Nordwall in "EMP, High-Powered Microwaves Pose New EW Threat to Aircraft," *Aviation Week,* p.68, October 26, 1998

I do claim credit for one major, but generally unrecognized, development. In 1971 after considerable study, I wrote a memo predicting that the apparent problem of microwave radiation hazards would eventually disappear and be replaced by interference as the real limiting environmental problem. Thirty years later my prediction is being borne out, as is evidenced by the following: The power line scare is being closed out. Microwave scares continue to exist, but do not slow the explosive growth of wireless communications....

—Dr. John Osepchuk, consultant, Concord, MA, formerly with Raytheon Co., in a guest editorial, "Predictions and Breakthroughs," *Journal of Microwave Power & Electromagnetic Energy, 33,* p.142, 1998

Rule 1: There is no claim so preposterous that a PhD physicist cannot be found to vouch for it.

—Dr. Robert Park, American Physical Society, Washington, in "Voodoo Science: Perpetuum Mobile," *Physics & Society,* p.4, October 1998

Circadian Information, Cambridge, MA, mails out materials touting its 12th annual Working Nights Family Calendar, which gives graveyard-shift workers tips for planning time with their families and improving overnight alertness. But at 3 am, a worker at the printing company doing the mailing sent 130,000 letters with incomplete addresses. Says Circadian's publisher, Ed Coburn: "I don't think they were using the product." The mailing was redone.

—Stacy Kravetz, "Working Week: Eyes Wide Shut," *Wall Street Journal,* p.1, November 24, 1998

"MICROWAVE NEWS" FLASHBACK

Years 15 Ago

• The Occupational Safety and Health Administration (OSHA) cancels plans to develop a new RF/MW safety standard, thereby insuring that the agency cannot enforce any RF/MW exposure limits—even under the general duty clause.

• Six men at the Clear Air Force Station in Alaska are exposed to high levels of radiation when the base's Ballistic Missile Early Warning System megawatt radar is accidentally turned on during routine maintenance.

• The U.S. ambassador in Moscow reveals that the Soviet Union is beaming microwave radiation at the embassy for the first time in four years. The Soviet Foreign Ministry denies it.

Years 10 Ago

• Citing possible EMI, the Radio Technical Commission for Aeronautics, which advises the Federal Aviation Administration, officially recommends that airline passengers turn off electronic devices during takeoffs and landings.

• The New York Power Authority discloses payments to three scientists at the National Cancer Institute (NCI) who served as its expert witnesses in the Marcy-South power line trial. NCI's Dr. Stuart Aaronson received over $70,000.

• The U.S. Air Force admits that its PAVE PAWS radar at Robins Air Force Base in Georgia may constitute an "electromagnetic danger" to passing aircraft carrying electro-explosive devices.

Years 5 Ago

• The University of North Carolina's Dr. Dana Loomis reports that women in electrical occupations have a 40% greater chance of dying from breast cancer than do those in other jobs.

• A Swiss study finds that people living near a powerful shortwave transmitter station in Schwarzenburg are more likely to suffer sleep disorders, high blood pressure and feelings of anxiety.

• The San Francisco school board prohibits mobile communications antennas on school property—the first such measure by a major city. "We didn't feel that the risk was warranted at all," says a member of the board.

1999 Conference Calendar (Part I)

January 4-8: **International Union of Radio Science (URSI) National Radio Science Meeting,** University of Colorado, Boulder. Contact for Commission K on Electromagnetics in Biology and Medicine: Dr. James Lin, Dept. of EECS, M/C 154, University of Illinois, 851 S. Morgan St., Chicago, IL 60607, (312) 413-1052, Fax: (312) 413-0024, E-mail: <lin@eecs.uic.edu>, Web: <cires.colorado.edu/ursi>.

January 11-13: **International Research Conference on Health Hazards and Challenges in the New Working Life,** Hotel Foresta, Stockholm, Sweden. Contact: Marianne Ekdahl, National Institute for Working Life, S-171 84 Solna, Sweden, (46+8) 705 89 44, Fax: (46+8) 730 98 60, E-mail: <marianne.ekdahl@niwl.se>.

January 31-February 4: **1999 IEEE Power Engineering Society (PES) Winter Meeting,** Hilton Hotel, New York, NY. Contact: IEEE PES, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855, (908) 562-3883, Fax: (908) 981-1769, E-mail: <pes@ieee.org>, Web: <www.ieee.org/power>.

February 1-2: **2nd State of the Science Colloquium on the Public Health Impact of Wireless Technology,** Marriott Metro Center, Washington, DC. Contact: Wireless Technology Research, 1711 N St., NW, Washington, DC 20036, (202) 833-2800, Fax: (202) 833-2801, E-mail: <wtr@hesgroup.com>.

February 8-10: **Wireless '99,** Ernest Morial Convention Center, New Orleans, LA. Contact: Jeffrey Nelson, Cellular Telecommunications Industry Association, 1250 Connecticut Ave., NW, Suite 200, Washington, DC 20036, (202) 736-3207, E-mail: <JNelson@ctia.org>.

February 16-18: **13th International Zurich Symposium & Technical Exhibition on Electromagnetic Compatibility,** Swiss Federal Institute of Technology, Zurich, Switzerland. Contact: Dr. Gabriel Meyer, ETH Zentrum-IKT, CH-8092 Zurich, Switzerland, (41+1) 632 27 90, Fax: (41+1) 632 12 09, E-mail: <gmeyer@nari.ee.ethz.ch>, Web: <www.nari.ee.ethz.ch/emc>. See p.16.

February 28-March 5: **10th International Montreux Congress on Stress,** Grand Hotel Excelsior, Montreux, Switzerland. Contact: Dr. Paul Rosch, American Institute of Stress, 124 Park Ave., Yonkers, NY 10703, (914) 963-1200, Fax: (914) 965-6267, E-mail: <stress124@earthlink.net>, Web: <www.stress.org>. See p.8.

March 15-17: **1999 Annual Meeting of the Society of Toxicology,** Ernest Morial Convention Center, New Orleans, LA. Contact: Society of Toxicology, 1767 Business Center Dr., Suite 302, Reston, VA 20190, (703) 438-3115, Fax: (703) 438-3113, E-mail: <trish@toxicology.org>, Web: <www.toxicology.org>.

March 22-26: **Progress in Electromagnetics Research Symposium (PIERS 1999),** Taipei International Convention Center, Taipei, Taiwan. Contact: Prof. Kun Shan Chen, Center for Space and Remote Sensing Research, National Central University, Chung-Li, Taiwan, (886+3) 425-7232, Fax: (886+3) 425-4908, E-mail: <dkschen@csrsr.ncu.edu.tw>, Fax: <piers1999.csrsr.ncu.edu.tw>.

March 27-April 1: **30th Annual Meeting of the Environmental Mutagen Society,** Capitol Hilton, Washington, DC. Contact: Elizabeth Von Halle, 113 Wendover Circle, Oak Ridge, TN 37830, (423) 483-5805, Fax: (423) 574-9888, E-mail: <liz@ornl.gov>, Web: <www.ornl.gov/TechResources/ems/futanc.html>.

March 28-31: **1999 Electric Power Research Institute (EPRI) EMF Science Seminar,** Hyatt Regency Downtown, Denver, CO. Contact: Robert S. Banks Associates Inc., PO Box 141049, Minneapolis, MN 55414, (612) 623-4600, Fax: (612) 623-3645, E-mail: <vlprock@rsba.com>.

March 29-31: **Electricity '99 Conference and Exposition,** Hyatt Regency, Vancouver, BC, Canada. Contact: Canadian Electricity Association, 1155 Metcalfe St., Suite 1120, Montreal, Quebec H3B 2V6, Canada, (514) 866-6121, Fax: (514) 866-1880, E-mail: <info@canelect.ca>, Web: <www.canelect.ca>.

April 2-4: **18th Southern Biomedical Engineering Conference** and **2nd International Conference on Ethical Issues in Biomedical Engineering,** Clemson University, Clemson, SC. Contact: Dr. Subrata Saha, Bioengineering Alliance of South Carolina, 313 Rhodes Research Center, Clemson University, Clemson, SC 29634, (864) 656-7603, Fax: (864) 656-4466, E-mail: <ssaha@clemson.edu>, Web: <sbec.abe.msstate.edu>.

April 6-8: **61st Annual Meeting of the American Power Conference,** Marriott Downtown, Chicago, IL. Contact: Robert Porter, Illinois Institute of Technology, 10 W. 32nd St., Chicago, IL 60616, (312) 567-3196, Fax: (312) 567-3892, E-mail: <apc@iit.edu>, Web: <apc.iit.edu>.

April 7-8: **35th Annual Meeting of the National Council on Radiation Protection and Measurements (NCRP),** Crystal City Marriott, Arlington, VA. Contact: NCRP, 7910 Woodmont Ave., Suite 800, Bethesda, MD 20814, (301) 657-2652, Fax: (301) 907-8768, E-mail: <ncrp@ncrp.com>, Web: <www.ncrp.com>.

April 11-16: **1999 IEEE PES Transmission and Distribution Conference and Exposition,** Ernest Morial Convention Center, New Orleans, LA. Contact: Dennis Doss, BICC Cables, 1 Crosfield Ave., West Nyack, NY 10994, (914) 353-4000, Fax: (914) 353-0542, E-mail: <ddoss@BICCCables-na.com>, Web: <www.99ieeet-d.org>.

April 20-22: **1999 IEEE Radar Conference,** Boston, MA. Contact: Robert Alongi, 255 Bear Hill Rd., Waltham, MA 02154, (781) 890-5290, Fax: (781) 890-5294, E-mail: <sec.boston@ieee.org>, Web: <www.ieee-boston.org/radar99>.

April 23-30: **58th Annual American Occupational Health Conference,** Ernest Morial Convention Center, New Orleans, LA. Contact: Kay Coyne, American College of Occupational and Environmental Medicine, 55 W. Seegers Rd., Arlington Heights, IL 60005, (847) 228-6850, Fax: (847) 228-1856, E-mail: <kcoyne@acoem.org>, Web: <www.acoem.org>.

April 27-29: **17th Symposium on Explosives and Pyrotechnics,** Philadelphia Airport Holiday Inn, Essington, PA. Contact: Franklin Applied Physics Inc., 98 Highland Ave., PO Box 313, Oaks, PA 19456, (610) 666-6645, Fax: (610) 666-0173, E-mail: <FrankPhys@aol.com>, Web: <members.aol.com/FrankPhys>.

May 9-12: **31st Annual National Conference on Radiation Control,** Hyatt Regency Hotel, Louisville, KY. Contact: Lin Carigan, Conference of Radiation Control Program Directors, 205 Capital Ave., Frankfort, KY 40601, (502) 227-4543, Fax: (502) 227-7862, E-mail: <cariganlin@aol.com> or <lcarigan@crcpd.org>, Web: <www.crcpd.org>.

May 18-21: **International Magnetics Conference: Intermag '99,** Kyongju, Korea. Contact: Korean Magnetics Society, Korea Science and Technology Center, Room 905, Yeoksam-dong 635-4, Kangnam-ku, Seoul 135-703, Korea, (82+2) 967-0518, Fax: (82+2) 967-0518, E-mail: <intermag@kistmail.kist.re.kr>, Web: <intermag99.kist.re.kr>.

May 22-28: **7th Scientific Meeting and Exhibition of the International Society for Magnetic Resonance in Medicine (ISMRM),** Pennsylvania Convention Center, Philadelphia, PA. Contact: ISMRM, 2118 Milvia St., Suite 201, Berkeley, CA 94704, (510) 841-1899, Fax: (510) 841-2340, E-mail: <info@ismrm.org>, Web: <www.ismrm.org>.

June 7-8: **WHO/ICNIRP International Seminar on Health Effects of Exposure to 300 Hz to 10 MHz Electromagnetic Fields,** Maastricht, the Netherlands. Contact: R. Matthes, Institut für Strahlenhygiene, Bundesamt für Strahlenschutz, Ingolstädter Landstrasse 1, D-85764 Oberschleißheim, Germany, (49+89) 31603 288, Fax: (49+89) 31603 289, E-mail: <RMatthes@bfs.de>, Web: <www.who.ch/emf/>. On June 9-10, following the seminar, working group meetings will be held for speakers and interested participants. For more information, contact: Dr. Michael Repacholi, World Health Organization, CH-1211 Geneva 27, Switzerland, (41+22) 791-3427, Fax: (41+22) 791-4123, E-mail: <repacholim@who.ch>.

June 10-12: **32nd Annual Meeting of the Society for Epidemiologic Research (SER),** Baltimore, MD. Contact: SER, PO Box 64655, Baltimore, MD 21264, E-mail: <stacey@caat.spharbor.jhu.edu>, Web: <www.jheph.edu/pubs/jepi/serdates.htm>.

June 20-24: **21st Annual Meeting of the Bioelectromagnetics Society,** Hyatt Regency Hotel, Long Beach, CA. Contact: W/L Associates, 7519 Ridge Rd., Frederick, MD 21702, (301) 663-4252, Fax: (301) 371-8955, E-mail: <75230.1222@compuserve.com>, Web: <biomed.ucr.edu/bems.htm>.

June 27-July 1: **44th Annual Meeting of the Health Physics Society (HPS),** Marriott Hotel, Philadelphia, PA. Contact: HPS, 1313 Dolley Madison Blvd., Suite 402, McLean, VA 22101, (703) 790-1745, Fax: (703) 790-2672, E-mail: <hps@burkinc.com>, Web: <www.hps.org>.

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UPDATES

MEETINGS

Zurich Workshops... On February 18 at the EMC meeting in Zurich, Switzerland, there will be a workshop on *Electromagnetic Terrorism and Adverse Effects of High-Power Electromagnetic Environments,* which is designed to heighten awareness of intentional and accidental threats in the context of information warfare. And on February 15, the day before the conference officially opens, COST 244 will host an *Open Meeting on Biomedical Effects of EMFs,* which will focus on exposure systems and dosimetry. For more information, see p.15.

MICROWAVE WEAPONS

Human Testing Lawsuit Dismissed... In September, a lawsuit brought by the International Committee on Offensive Microwave Weapons (ICOMW) was dismissed in the U.S. district court in Washington. "We were asking the court to enforce a presidential memorandum which bans involuntary research on human subjects," said the group's director, Harlan Girard. The Philadelphia-based organization had alleged that the DOD and the CIA have conducted such experiments in their efforts to develop weapons systems using EMFs, lasers, microwaves and sound waves (see *MWN,* M/J98). The judge ruled that the group did not have standing to bring suit because the people alleged to have suffered from such testing were not ICOMW members. She acknowledged that Girard himself was a member, but stated that his own complaints were "too generalized and nonspecific to support a complaint." Girard told *Microwave News* that the ICOMW could not afford an appeal. Instead, he said, the committee plans to raise the matter with the Inter-American Commission on Human Rights. A new report from the Coalition Against Torture and Racial Discrimination, an alliance of 15 U.S. human rights groups, states that the lawsuit's charges deserve attention. "Given the past history of secret experimentation by the government," the anti-torture group declares, "these allegations of continuing...government-sponsored human testing should not be dismissed without more thorough, impartial investigation."

MILITARY RADAR

PAVE PAWS Advisory Panel... The Massachusetts Department of Public Health in Boston has formed a scientific panel to address public concerns about the U.S. Air Force's PAVE PAWS missile defense radar on Cape Cod (see p.6 and *MWN,* M/J87 and J/A98). Dr. Linda Erdreich of Bailey Research Associates, a consulting firm in New York City, is the group's chair. The other members are Dr. Om Gandhi of the University of Utah, Salt Lake City, Dr. Henry Lai of the University of Washington, Seattle, and Dr. Marvin Ziskin of Temple University Medical School in Philadelphia. The panel's first public meeting, which was originally scheduled for December 2, has been postponed until early 1999.

PEOPLE

Koslov's Collection... On November 18, Christie's in London auctioned the collection of scientific and photographic instruments and books assembled by Dr. Samuel Koslov, who died

last year (see *MWN,* N/D97). Koslov was one of the original policy makers on RF/MW health effects and a longtime member of ERMAC, a federal advisory committee for a time based at the White House. As noted in the Christie's sale catalog (No. 8200), "This collection represents one man's passion for life, through and behind the lenses of cameras, microscopes, microscope slides and related books." Over 600 items were auctioned, bringing in close to £250,000, or approximately $400,000 (including commissions).

PROTECTIVE CLOTHING

Performance Standard... The IEEE standards committee (SCC-34) on Electromagnetic Energy Product Performance Safety has established a new subcommittee to address RF/MW protective clothing, chaired by Richard Tell, a consultant based in Las Vegas. Tell told *Microwave News* that the subcommittee will develop a standard for evaluating the performance of such garments. The starting point, Tell said, is a standard that has been drafted in Germany. The first meeting of the subcommittee will be held on January 27 at the Motorola labs in Fort Lauderdale, FL. For more information, contact Tell at: (702) 645-3338, Fax: (702) 645-8842 or E-mail: <rtell@radhaz.com>. Another SCC-34 subcommittee is working on certifying the compliance of wireless devices with SAR limits (see *MWN,* M/A97).

REPRODUCTIVE EFFECTS

Radar and Male Fertility... In 1992, a joint study by the U.S. Army and NIOSH found that men exposed to RF/MW radiation from radars had significantly lower sperm counts than did controls or soldiers who may have been exposed to airborne lead. (The researchers, led by Dr. Timothy Weyandt, then at the Army's Biomedical R&D Labs in Frederick, MD, and now at Pennsylvania State University in University Park, had originally planned to use the radar operators as controls; see *MWN,* M/A93.) But a follow-up study by a team led by NIOSH's Dr. Steven Schrader in Cincinnati and including Weyandt found only small differences between another radar-exposed group—signal corps men—and controls (see *MWN,* M/J96). Results of the 1992 study, previously available only in a little-known Army technical report, were published in *Reproductive Toxicology* in 1996 *(10,* pp.521-528). Now, the follow-up study, first reported at a conference in April 1996, has also been published in *Reproductive Toxicology (12,* pp.465-468, 1998). Noting that the earlier study looked at men who worked with radar in intelligence gathering rather than in the signal corps, Schrader and colleagues write that, "There are many conditions that may influence the potential health effects of radar," including "power level, pulse width and frequency band," as well as the transmitter's design and its proximity to the operator. "More data are needed," they write, "to evaluate the relationship between military radar and male reproductive health." But, they warn, "Collecting this type of information in a study of military operators is complicated" by the fact that much of it is classified. Weyandt and Dr. William James of University College of London, U.K., exchange letters on the studies' use of sperm count as an indicator of male fertility in the same issue of *Reproductive Toxicology (12,* pp.495-496).

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RESOURCES

Radiation Primer... The U.K.'s National Radiological Protection Board (NRPB) has published a new edition (the fifth) of *Living with Radiation,* its introductory text on the nature, uses and risks of radiation. Most of the book is devoted to ionizing radiation, but one chapter addresses EMFs and RF/MW. The board notes that, "[T]here is no basis on which to quantify the risk of cancer from ordinary exposure and so establish standards of protection." It goes on to argue that, "The subject is so important, however, that epidemiological and biological research will need to be focused on the issue of causation." Copies are available for £10.95 (approx. $18.00) each, which includes postage and handling, from: NRPB, Chilton, Didcot, Oxon OX11 0RQ, U.K., Fax: (44+1235) 833891, Web: <www.nrpb.org.uk>.

SIGNAL-TO-NOISE

300,000 Penguins at a Cocktail Party... Whether at a social gathering, in a crowded store or on a noisy street, people can often pick out familiar voices despite high levels of background noise. Psychologists call this "the cocktail party effect." But could you do it at a cocktail party for 300,000? That's the size of some breeding colonies of king penguins in the Antarctic, and they are not quiet places. Yet penguin chicks rely mainly on sound, not sight or smell, to find their parents. The October 15 issue of *Nature* reports that researchers measured "the background cacophony" and calculated that the chicks should not be able to identify their parents' calls beyond a distance of 8-9 meters. But in behavioral experiments, the chicks picked out their parents' sounds at almost twice that distance. "This remarkable feat of auditory discrimination is yet to be explained," notes *Nature*.

Keeping Current: Follow-Up on the News

◆ During his triumphant return to space in the space shuttle, Sen. John Glenn (D-OH) did not experiment with melatonin as originally planned (see *MWN,* M/A98). Glenn did, however, take Metamucil, according to the *Washington Post* (October 28).

◆ The U.K.'s *Sunday Times* reported on November 22 that Richard Branson, the Virgin business group tycoon, "warned his staff about the potential risk of mobile phones" after a close friend, who was a heavy user, died of a brain tumor. Branson ordered that all company mobile phones be issued with headsets, according to the November 29 *Observer.*

◆ The California EMF Program has moved to Oakland. The new address is 1515 Clay St., 17th Floor, Oakland, CA 94612. The main telephone number is now (510) 622-4500. The E-mail addresses are unchanged. M.A. Stevenson, who helped administer the program, has changed jobs and is now with the California Public Utilities Commission.

◆ The National Transportation Safety Board has asked NASA and the U.S. Navy to investigate whether EMI could have played a role in the explosion of TWA Flight 800 in July 1996, *Aviation Week* reported in its November 2 issue. The possibility was raised earlier this year by a Harvard professor of English literature (see *MWN,* M/A98).

◆ In our last issue, we reported on some of the factors that might explain the elevated rates of breast cancer among flight attendants—including lower melatonin levels due to chronic jet lag. In the October 24 issue of *The Lancet,* Drs. Margo Barker and Jodi Stookey raise a new possible risk factor: dehydration associated with flying.

◆ The court date for the challenge to the FCC's RF/MW exposure rules has been delayed again. It is now scheduled for the week of January 11, 1999.

◆ It's not just electricity anymore: "EPRI" is now preferred to the name "Electric Power Research Institute."

As We Go to Press

◆◆ Sony Electronics Inc. is contacting the U.S. users of an estimated 60,000 Sony dual-band wireless phones because some of the units may cause exposures that are in excess of the limits adopted by the FCC. For more information, contact: (888) 914-SONY. ◆◆

◆◆ Dr. Daniel Wartenberg's paper, "Residential Magnetic Fields and Childhood Leukemia: A Meta-Analysis," appears in the December issue of the *American Journal of Public Health.* ◆◆

VIEWS ON THE NEWS

What We Would Like To See in 1999

Here is our wish list for next year.

Give Wertheimer the d'Arsonval Award

The Bioelectromagnetics Society (BEMS) should award its d'Arsonval prize for "extraordinary accomplishments" to Dr. Nancy Wertheimer. Her seminal epidemiological studies, carried out without any outside funding, have forever changed the EMF landscape, prompting international interest in EMF health research.

Wertheimer's 1979 hypothesis linking power line magnetic fields and childhood cancer raised an important question of public health. She inspired a great many researchers to look into this problem—including some of the world's leading epidemiologists.

Wertheimer and Ed Leeper's findings have been borne out by many other studies. One exception is the recent effort by the National Cancer Institute (NCI), but there are reasons to believe that this was due to the design of the institute's study, not problems with Wertheimer's hypothesis.

Whatever else may be said about the 1996 National Academy of Sciences report on EMFs, the academy did conclude that there is indeed an association between living near high-current power lines and childhood cancer, which is precisely what Wertheimer has been saying for 20 years.

Wertheimer deserves recognition, and it is long overdue. Tell this to Dr. Larry Anderson, the chairman of BEMS' awards committee, at <le_anderson@pnl.gov> or by fax to (509) 375-3764.

FDA: Stop the WTR Charade

The Food and Drug Administration (FDA) must stop allowing itself to be used as a fig leaf to cover up Dr. George Carlo's failure to sponsor serious research on cell phone health risks.

For more than five years, the FDA's Center for Devices and Radiological Health has played along as Carlo has used every possible tactic to avoid doing the one thing he was hired to do: find out whether cell phone radiation can promote brain tumors.

Now, the FDA is almost an accessory to the hoax perpetrated by Carlo and his group, Wireless Technology Research (WTR). The FDA is trapped by its own inaction: Agency staffers cannot be too critical of WTR, lest someone ask why the FDA did not speak out on WTR's scam earlier.

After spending years drawing up the perfect research agenda, Carlo threw his own plan out the window last December: He announced that he had no intention of carrying out lifetime animal exposure studies, the centerpiece of any risk assessment. And, in a recent interview, Carlo had the gall to tell Jeffrey Silva of *RCR* that doing biological research of any kind isn't worth the effort (see p.14). The only thing Carlo is now advocating is "surveillance." That is, someone—no doubt Carlo himself for a fat fee—should watch and see whether large numbers of people keel over after using mobile phones.

It's time for Drs. Elizabeth Jacobson, Russell Owen and others at the FDA to say that the emperor has no clothes. The FDA must acknowledge that WTR and the Cellular Telecommunications Industry Association (CTIA) have not done, and will not do, the safety research that consumers need. Federal health agencies must take the responsibility for making sure that this work gets done.

A WHO EMF Project for All of Us

We look forward to an International EMF Project at the World Health Organization (WHO) that takes the public interest as seriously as the interests of the cell phone industry, the electric utilities and the U.S. Air Force (see, for instance, p.2).

The project's latest initiative is to "harmonize" worldwide electromagnetic exposure standards. The objective is to promote global trade rather than public health. Previously, WHO's Dr. Michael Repacholi tried to convince Australia and New Zealand to adopt the weaker limits of the ICNIRP, but he was voted down.

We find it more than peculiar that in one breath Repacholi tells us that a decision to favor prudent avoidance is best left to national governments (see p.10), while in the next breath he says that they should all follow his lead in setting exposure standards.

Perhaps what is missing is the personal oversight of WHO Director-General Dr. Gro Harlem Brundtland.

Some Preferred Stocking Stuffers

• The release of the Environmental Protection Agency's and the National Council on Radiation Protection's EMF health reviews. Both point to cancer risks and were paid for with public money. They have been suppressed for far too long.

• An independent and honest investigation of the *Kvikk* birth defect cluster in Norway (see p.4).

• Broad-based research on EMFs and neurological diseases such as Alzheimer's and ALS.

• A less secretive U.K. National Radiological Protection Board.

• The return of Hydro-Québec's data set on exposures to high frequency transients and cancer to Canada's McGill University and its release to any other interested researchers. (Some protests from other epidemiologists against this long-running corporate cover-up would be a good beginning.)

• Experimental data that explain how hand-held Iridium phones, which can send signals to satellites orbiting close to 500 miles overhead, meet exposure limits that can be a challenge for a phone that only has to reach a cell site a few miles away.

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A Wish for the New Year

Standards Harmonization Meeting: Russia and West Far Apart

East met West in September at a Moscow conference on radiation safety—but neither side blinked.

Russian limits for radiofrequency and microwave (RF/MW) radiation exposures are up to 100 times stricter than those in the U.S. and Western Europe. Despite extensive discussions and vodka toasts at the Moscow conference, no compromise is in sight. It appears that the gulf that has separated the two sides for more than 30 years will remain for some time to come.

The latest effort to bridge the gap — or to "harmonize" RF/MW standards — took place at the *2nd International Conference on Problems of Electromagnetic Safety of the Human Being*, held in Moscow, September 20-24. The meeting was sponsored by the Russian National Committee on Non-Ionizing Radiation Protection (RNCNIRP) and a host of other Russian scientific groups, in cooperation with the World Health Organization (WHO), the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and the U.S. Air Force (USAF). Scientists from 12 countries took part.

"So far we have entirely different approaches to harmonization," Professor Yuri Grigoriev stated at the conference. Grigoriev chairs the recently formed RNCNIRP and is a senior research scientist at the Institute of Biophysics in Moscow.

Grigoriev's point was underscored by the fact that the meeting did not result in adoption of any joint statement or action plan on harmonization.

Western standard-setting organizations have emphasized protection from

(continued on p.9)

Wireless Industry Seeks To Raise RF/MW Exposure Limit for the Ear

Wireless phone manufacturers want to relax the radiation exposure standard for the outer ear, and the Institute of Electrical and Electronics Engineers (IEEE) is expected to give its approval. The request came just weeks after a report that many mobile phones violate current limits by overexposing the ear.

"C.K. Chou [of Motorola] proposed that, for the general public, the outer ear should be considered an extremity, similar to the hands, feet, wrists and ankles," said Ron Petersen, secretary of the IEEE's Standards Coordinating Committee 28 (SCC-28). The IEEE's RF/MW standard allows higher exposures for these extremities than for the rest of the body.

Chou introduced the subject in Atlanta at the October 17 meeting of SCC-28's Subcommittee 4 (SC-4), which deals with standards from 3 kHz to 300 GHz. Dr. Veli Santomaa of Nokia then gave a presentation in support of the proposal. Although "the SAR in the ear is the highest in the body," Santomaa

(continued on p.11)

Large Swedish Occupational Study Suggests EMFs May Affect Hormone-Related Cancers

A new study by Dr. Birgitta Floderus of the Karolinska Institute in Stockholm suggests that EMFs may increase the risk of cancer by interacting with estrogen and other hormones.

Floderus examined the incidence of all types of cancer and occupational EMF exposures among 2.4 million people. She found small but significant risks for a wide range of specific cancers, many of which are hormone-related. Floderus presented initial results in 1995 (see *MWN,* S/O95), and has now published the completed study in the October issue of *Cancer Causes and Control (10,* pp.323-332, 1999).

The research was not intended to test a particular theory. Rather, its aim was to generate hypotheses for future study, particularly to see if the data might "suggest possible biological pathways" for an EMF–cancer mechanism.

"The outcome suggests an interaction with the endocrine/immune system," Floderus and colleagues conclude. In particular, they write, reproductive hormones may be involved: "The results of the present study are coherent with a mechanism involving gonadal hormones, possibly estrogens." There are no commonly accepted theories about how such an EMF–estrogen mechanism might operate.

Among women, there was "a clear association" between working in EMF-exposed jobs and the risk of cancer of the uterine lining (endometrial cancer). EMF-exposed women also showed some increases in ovarian cancer and breast cancer. "The most notable finding for men," Floderus writes, "was an increased risk of testicular cancer in young workers."

Floderus also found that EMF exposure was linked to liver cancer, which is known to be hormone-related, and to malignant melanoma, thought by many to be associated with estrogens.

What do hormone-related cancers have in common? "*In vitro,* most hormone-related cancers respond to estrogens with increased cell proliferation, whether or not they were caused by estrogens in the first place," Dr. Michele Marcus, an epidemiologist at Emory University in Atlanta, said in an interview. Marcus noted that testicular, breast and prostate cancers are all hormone-sensitive and have increased in recent years, and that "some people have blamed pesticides and other compounds that might mimic naturally occurring hormones and act as environmental endocrine disrupters." But Marcus believes that hormone sensitivity is "a pretty tenuous link" among these different cancers. Any sort of theory about a common etiology, she said, "at this point is pure speculation."

Dr. Michael Gallo agreed: "The underpinning of hormonal carcinogenesis is that the tissues react to the hormones in terms of proliferation." Gallo, of the Environmental Occupational Health Sciences Institute in Piscataway, NJ, added, "But we don't know a lot about what causes abnormal or uncontrolled proliferation."

Interestingly, Floderus found that cancers which have shown the greatest increases in recent years had a particularly consistent link to EMF exposure. She did a joint analysis of cancers with the largest annual increases in Sweden from 1965 to 1984, and found that they were about 20% more likely to occur among those with medium and high EMF exposures than among others. These included liver, lung and skin cancers and non-Hodgkin's lymphoma, as well as testicular and prostate cancers among men and breast cancer among women.

Does this mean that these cancers may have increased in part because of EMF exposures? "I do not want to speculate on that question," Floderus told *Microwave News*. "The results show statistical associations and nothing more." She added, however, that, "Some of these results need an explanation."

Until now, no large occupational study of EMFs had taken a systematic look at cancer at all sites. Past studies of workplace EMF exposure focused on leukemia and brain cancer, and tended to find associations with both. According to Floderus, two meta-analyses by EPRI show "that there is an overall statistical association for both leukemia and brain tumors, and that it is unlikely that this association, although weak, is caused by chance" (see *MWN,* J/F96 and N/D97; also S/O99).

Floderus based her all-site study on national census and cancer registry data. She found elevated risks for most of the specific cancers she examined — increases that were modest but often statistically significant. In addition to the hormone-related cancers cited above, there were significant increases in chronic lymphocytic leukemia among women, colon and brain cancers among men and lung cancer among both sexes. People with medium or high EMF exposures had a significant increase of about 10% in overall cancer risk.

"The overall increase in cancer incidence is probably not due to chance, because the statistical precision is very high," Floderus said. "But this does not necessarily mean that the association reflects causality." She stressed that unidentified confounders could also explain the results.

In support of a possible hormone connection, however, Floderus's paper cites a previous study in which she observed a rise in pituitary tumors among male train drivers and conductors (see *MWN,* M/J94). This finding "adds to the credibility [of the idea] that the endocrine glands/hormones are involved in the potential pathway between magnetic fields and cancer," she writes. For testicular cancer in particular, Floderus contends that her latest findings are unlikely to be the result of confounding, "considering the outcome for other hormone-dependent cancers and the large number of occupations contained in the exposure groups."

"The most consistent site-specific associations were seen for genital cancers and malignant melanoma," the paper notes.

Floderus suggests that future research focus on specific hormone-related cancers. "For example," she said, "a robust case-control study of endometrial cancer, with a careful assessment of magnetic field exposure and potential confounding factors, such as obesity and reproductive history," would be quite useful.

In an interview, Dr. Sam Milham of Olympia, WA, formerly with the Washington state Department of Social and Health Services, commented, "It's interesting that in Bill Guy's study of microwave-exposed rats, there were a lot of cancers that had an endocrine tie" (see *MWN,* J/A84).

Floderus's paper cautions that "all associations observed were weak," with few increases exceeding 20%-30%. But, she notes, "Large cohort studies based on registry data, involving millions of people and long follow-up times, seldom produce strong associations," partly because they assess exposure through "crude surrogate measures" such as job titles.

Imprecise estimates of EMF exposure in various jobs and variability of exposure within job titles lead to exposure misclassification. Because of this, Floderus explains, her risk estimates would probably understate any "true association between magnetic field exposure and disease."

Exposure assessment was based on a job exposure matrix encompassing the 100 most common jobs in Sweden, developed by Floderus for her landmark study of EMFs and cancer on the job (see *MWN,* S/O92). For Floderus's new study, ten other jobs were added to increase the number of highly exposed subjects. Exposure categories were relative, with male and female workers each divided into thirds. Risks were calculated relative to the third of each group with the lowest exposure.

"No obvious exposure-response relationships were observed," Floderus writes, which may reflect a lack of any real causal connection. Alternatively, she writes, it might be that because of exposure misclassification, "there is, in fact, no meaningful difference between medium and high exposure" groups.

Cancer was more strongly associated with working in EMF-exposed jobs among men than among women. Floderus points out that women in the high-exposure group had lower average exposures than did their male counterparts. More generally, she notes, "The job exposure matrix was developed on male workers only and may not have the same validity for women."

It is possible, she writes, that women could be less exposed to industrial carcinogens that can initiate various types of cancer. There may also be "a sex-specific sensitivity to intermediate factors in the [EMF–cancer] pathway, for example estrogens." In the latter case, male workers could face a greater risk from a given level of EMF exposure.

Late-Breaking News from the U.K.

No Childhood Cancer Link at Low Magnetic Field Levels; Aerosol Pollutants Stronger in Power Line Environments

As we go to press in early December, two sets of studies have been published in the U.K. One casts doubt on the likelihood of an association between low-level 50 Hz magnetic fields and cancer, and the other points to the area near power lines as a breeding ground for cancer-causing particles.

The long-awaited U.K. childhood cancer epidemiological study appeared in the December 4 issue of *The Lancet*. "This major study provides firm evidence that exposure to the levels of magnetic fields found in the U.K. does not augment risk for childhood cancer," said Professor Richard Doll, who directed the study.

In an accompanying editorial, Drs. Michael Repacholi of the World Health Organization in Geneva and Anders Ahlbom of the Karolinska Institute in Stockholm countered that the new study "is not the 'definitive' study many scientists have been hoping for." They pointed to the small number of children exposed to more than 2 mG (0.2 μT) and to the use of time-weighted average fields to assess exposures. They want to see exposures to transients included in future studies.

Professor Nick Day of the University of Cambridge, who led the EMF part of the U.K. study, measured the fields for more than 4,000 children under the age of 14 — half of whom had cancer, including more than 1,000 with leukemia. Among the children with leukemia, only 21 had average exposures of 2 mG or more and only five had exposures of 4 mG or more.

"Our results are consistent with those of larger studies on childhood leukemia that use measured fields," Day concluded, adding that the study "contributes little evidence" on exposures above 4 mG.

Electric field exposures were also measured, but these results have not yet been released.

In addition to EMFs, the U.K. researchers are investigating the possible influence of the children's and their parents' exposures to ionizing radiation and toxic chemicals, as well as the role of infectious agents. The cancer study, which is costing over £11 million (US$17.5 million), was first announced more than seven years ago (see *MWN,* M/A92).

In the same issue of *The Lancet,* a group from the U.K. and New Zealand, led by Dr. John Dockerty of the University of Oxford, reported a similar lack of an association in a smaller study of childhood leukemia in New Zealand. Repacholi and Ahlbom noted that this effort has the "same inadequacies" as the U.K. study.

Just before the release of the U.K. Childhood Cancer Study, researchers at the U.K.'s University of Bristol announced that they have new experimental data showing that exposures to airborne pollutants are considerably higher in the vicinity of high-voltage power lines.

The Bristol team, led by Professor Denis Henshaw and Dr. Peter Fews, concluded that people living near high-voltage power lines are exposed to higher levels of both ionizing radiation from naturally occurring radon byproducts and carcinogenic chemicals from traffic exhaust. The team based this finding on over 2,000 experimental observations.

In a second paper, Henshaw and colleagues showed that the aerosol pollutants in power line environments tend to be charged and are therefore more readily deposited in the lungs — where they can do the most damage — of those living within a few hundred meters of lines of 132 kV or higher.

"We suggest that these results may be relevant to the reported associations between high-voltage power lines and childhood and adult leukemia," Henshaw said.

The two papers are in the *International Journal of Radiation Biology, 75,* pp.1,505-1,521 and pp.1,523-1,531, December 1999.

Henshaw first proposed that electric fields could increase exposure to radiation emitters known as "radon daughters" more than three years ago (see *MWN,* M/A96).

Disagreements Stall Interagency RAPID Report

The final report of the Interagency Committee (IAC) on the EMF RAPID program has been delayed due to disagreements among the eight participating federal agencies. As of early December, the content and the release date of the IAC report were in doubt. No meetings are scheduled before the end of the year.

"Perhaps we should simply say we agree with the NIEHS report and forget about writing our own," said one exasperated committee member.

Another IAC member was more optimistic that the differences could be resolved. He said that a meeting may not even be needed because the committee could work via e-mail.

The National Institute of Environmental Health Sciences' (NIEHS) report on the RAPID program, submitted to the U.S. Congress last June, concluded that there was "weak" evidence that EMFs pose a health risk (see *MWN,* J/A99).

White House science officials appear to be ambivalent about the need for any IAC report at all. A knowledgeable source told *Microwave News* that when Dr. Imre Gyuk of the Department of Energy (DOE), the chair of the IAC, contacted the White House Office of Science and Technology Policy (OSTP), he was told that a final report was not really necessary. But the IAC report is required by Congress under the Energy Policy Act of 1992, which established the RAPID program.

Gyuk, who is now the manager of DOE's research program on energy storage in Washington, declined to confirm or deny OSTP's reaction.

One of the most contentious points has been how specific the IAC's recommendations should be. For instance, one draft of the report cited 10 mG as "a value that identifies the most highly exposed populations and which could be used as a cut-point to identify how and for whom to target hazard awareness information so that individuals may elect to alter their exposures." This 10 mG action level was later deleted when two IAC members objected.

Robert Curtis of the Occupational Safety and Health Administration's Technical Center in Salt Lake City is one IAC member who wants to see some definition of what a "high" exposure level is. "The NIEHS report recommends an awareness program and that unnecessarily high exposures be prevented," he said in an interview, "and I want both these concepts in the IAC report."

The report has also been delayed by Dr. Michael Marron's move from the Office of Naval Research to the National Institutes of Health (NIH). Marron was the lead author of the IAC report, but in mid-November he resigned to become the associate director for biomedical technology at the NIH's National Center for Research Resources in Bethesda, MD.

The IAC report is now in its fourth or fifth draft. An earlier draft obtained by *Microwave News* concluded that, "Exposure to power frequency EMFs may pose some level of health risk," based on epidemiological studies of children exposed at home and of workers exposed on the job. The draft also noted that the "scientific evidence is not strong" and that "causality remains uncertain." It recommended that EMF health research continue, specifically pointing to breast cancer, heart disease and Alzheimer's disease as areas that would need more attention.

A more recent draft continued to endorse the NIEHS conclusions, and went on to argue that, "There is epidemiologic evidence for an exposure-response relationship with long-term average ELF magnetic field magnitudes."

When the IAC report is completed, it will mark the official end of the six-year EMF RAPID research and public information program.

IEEE Once Again Sets Out To Write an EMF Health Standard

The Institute of Electrical and Electronics Engineers (IEEE) has authorized its Standards Coordinating Committee 28 (SCC-28) to begin work on safety limits for extremely low frequency (ELF) EMFs. Kent Jaffa, who, as the chair of SCC-28's Subcommittee 3 (SC-3), is leading the effort, estimates that it will take a couple of years to complete the standard.

"I am trying to push this along in a timely manner," Jaffa, of PacifiCorp in Salt Lake City, told *Microwave News*. PacifiCorp is a utility headquartered in Portland, OR, that provides electricity in six western states as well as in Australia. The U.K.'s Scottish Power is in the process of buying PacifiCorp.

This is not the first time that SCC-28 has sought to write an EMF health standard. In 1991, after completing the revision of its RF/MW standard, the committee asked Dr. John Bergeron of GE and William Feero of Electric Research and Management to develop a set of limits for ELF frequencies (see *MWN,* N/D91), but they never completed the task. In 1993, SC-3 considered adopting the IRPA (now ICNIRP) guidelines to speed up the process, but its members were split. Some argued that the subcommittee itself should examine the underlying science (see *MWN,* N/D93). The effort languished when no agreement could be reached.

On September 16 of this year, the IEEE Standards Board started afresh and approved a new project to write safety limits for frequencies from 0 Hz to 3 kHz. They will be "based on the results of an evaluation of the relevant scientific literature and proven effects which are well established and for which thresholds of reaction are understood," according to a statement defining the scope of the project.

Jaffa has set up two working groups: Dr. Asher Sheppard, a consultant based in Redlands, CA, is establishing a process for reviewing the relevant EMF literature. And Patrick Reilly of Metatec Associates in Silver Spring, MD, is leading the group on mechanisms of EMF bioeffects.

Reilly's working group is writing the EMF exposure criteria. "Our goal is to develop a document for SCC-28 review within the next 12-18 months," he told *Microwave News*.

Sheppard is worried that the recent sharp cutback in EMF research funding could compromise the new effort. "I am concerned as to whether we have broad enough representation from the ELF research community to assure acceptance of our standard," he said in an interview.

HIGHLIGHTS

« Wireless Notes »

Dr. **Lennart Hardell** of the Örebro Medical Center in Sweden and colleagues have published a case report of an **angiosarcoma** (a rare type of soft tissue cancer) on the scalp of a 57-year-old woman who used both **cordless** and mobile phones. "The tumor developed in the anatomical area with the highest exposure to microwaves," they report in the November issue of *Epidemiology,* pointing out that "the highest absorption rate will be in the skin" for both types of phone. The woman used her cordless phone "at least one hour per day" for over ten years, but its maximum power output was quite low — only 10 mW. While she began to use a **GSM** mobile phone in 1994, this was only for "a few minutes per week." One of Hardell's collaborators, Dr. **Kjell Hansson Mild** of the National Institute for Working Life in Umeå, conceded that 10 mW is a very low exposure. But if microwaves do prove to be linked to cancer, he told *Microwave News,* it is unclear what the threshold for the effect might be.

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Senator Seeks GAO Report On Cell Phone Safety Research

Sen. Joseph Lieberman (D-CT) has asked the General Accounting Office (GAO) to investigate the current status of mobile phone safety research.

"In the last five years, the number of Americans using cellular telephones has increased dramatically," Lieberman stated in a letter to the GAO on October 20. "Uncertainty in this area persists, fueling the fears of phone users and spurring calls for further research."

In a 1994 report requested by Rep. Edward Markey (D-MA), the GAO concluded there was no proof of harmful effects from mobile phones (see *MWN,* N/D94). It noted, however, that bioeffects at other frequencies had been reported. The 1994 report urged that the FDA, EPA and FCC take steps "to maximize the usefulness, independence and objectivity" of the industry's five-year research program, WTR.

Five years later, Lieberman has asked the GAO to review: (1) Current evidence on mobile phone health risks; (2) The need for federal regulation; (3) What actions federal agencies took to bolster the independence and usefulness of WTR-sponsored research, as per the GAO's 1994 recommendation; (4) The "structure, methodology and findings of the industry's research program"; and (5) What government or industry could do to study possible health effects, and whether "precautionary safety measures" are needed.

A new GAO study looks likely, a staffer in Lieberman's office told *Microwave News,* though its scope and timetable have yet to be defined.

In 1992, Lieberman convened a Senate hearing on cancer and police radar guns (see *MWN,* M/J92 and S/O92). After Dr. Ross Adey testified on cellular phones and other RF/MW sources, Lieberman said, "Wow! There's a lot to be worried about here." He later allowed that this might be a "non-senatorial" response, but did not downplay the issue.

FDA Asks for Animal Studies

Last year the FDA proposed that the National Toxicology Program (NTP) study the health effects of RF/MW radiation from mobile phones, *Microwave News* has learned. The FDA described this as a high priority, calling for large-scale animal studies on cancer and on ocular and neurological effects. It specifically called for replication of the Australian study that found a doubling of cancer among mice exposed to a digital mobile phone signal (see *MWN,* M/J97).

Apparently, no decision has yet been made on the FDA's request. The NTP receives many such proposals each year. Dr. Errol Zeiger of the NTP in Research Triangle Park, NC, did not respond to repeated requests for comment.

In a letter in the *Journal of the American Medical Association* (November 17), Dr. **Nancy Dreyer** and her team at **Epidemiology Resources Inc.** in Newton Lower Falls, MA, break down the data from their study of wireless phone use and mortality (see p.14 and *MWN,* M/J96). For deaths from brain cancer and leukemia, no link to phone use was found. Deaths from auto accidents, however, increased with time spent on the phone. Dreyer notes billing data used in the study do not show whether a call was made while in a car: "A more accurate measure of telephone use while driving would likely show an even stronger effect."

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A number of the media stars in the ongoing cell phone-health controversy will be speaking next February 4 at a **workshop** sponsored by the **Bioelectromagnetics Society** at Catholic University in Washington. Drs. Ross Adey, Niels Kuster, Henry Lai and Alan Preece will all present their latest results. In addition, Sweden's Dr. Maria Feychting will give an update on the IARC brain tumor study and Australia's Dr. Ken Joyner will review research and regulation from an Asian-Pacific perspective. "The workshop is open to everyone and it's free," said FDA's Dr. Ewa Czerska, who is organizing the meeting with NIH's Dr. Lee Rosen. For contact information, see the conference calendar, p.15.

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German activists have an offer for those who claim that RF/MW radiation is harmless as long as it is below **ICNIRP** exposure limits. Citizens Wave (Bürgerwelle) will pay **20,000 DM** (more than US$10,000) to a volunteer who is willing to be exposed for ten days to mobile phone radiation at sublimit levels. Qualified subjects include wireless industry executives, government officials and standard setters such as Dr. **Jürgen Bernhardt**, the chair of ICNIRP, who also works in the Federal Radiation Protection Office in Oberschleißheim. "Now we will see how much [they] trust the limit values, which they have declared fit for the general public," said spokesperson Siegfried Zwerenz.

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A report on the mobile phone market from the Geneva-based

International Telecommunication Union (ITU), released in October, has some provocative statistics. The number of users in all countries, 319 million at the end of 1998, is expected to grow to 491 million by the end of 2000, and to 1 billion by 2004. At that point, the ITU predicts, there will for the first time be more wireless than wired phones worldwide. That is already true in Cambodia, Finland and Italy.

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Toys "R" Us and wireless service provider **Optus Communications** have drawn fire in **Australia** for marketing mobile phones to children. In a new joint venture, the toy store chain will begin selling phones with prepaid service this holiday season. **Senator Lyn Allison** calls the deal "reprehensible, given long-term concerns over the effects of electromagnetic radiation from mobile phones on children." The Consumers' Telecommunications Network and the **Australian Family Association** have also spoken out against the campaign, with the association asking parents to "shop elsewhere for toys for their children." Meanwhile, in the U.S., **AT&T** is now marketing phones with pictures of Mickey Mouse and Donald Duck on the front.

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The **Furby**, a stuffed electronic doll, caused no **EMI** to medical devices in tests by Canada's federal health agency. The tests were spurred by reports that the Royal Hospital for Sick Children in Glasgow, Scotland, had banned Furbys from its intensive care unit. Some airlines have also banned Furbys because of EMI concerns (see *MWN,* S/O99). **Health Canada**'s Medical Devices Bureau tested a Furby with devices used in hospitals, including an incubator, an infusion pump, a ventilator, a pacemaker and a kidney dialysis machine. "The Furby did not affect the performance of any of the 13 medical devices tested at any distance," write Drs. Kok-Swang Tan and Irwin Hinberg in a letter in the October 19 issue of the *Canadian Medical Association Journal*. (The letter is on the Web at <www.cma.ca/cmaj>.) The Furby did generate broadband EMFs, but Tan and Hinberg report that these were far weaker than those from a digital mobile phone.

SAR Search

• Since August 1996, manufacturers have been required to file SAR data with the **FCC** before marketing new phones in the U.S. (see *MWN,* J/A96). After ABC's ***20/20*** noted this fact in its October 20, 1999, broadcast on wireless phone safety (see p.7), some viewers asked the agency for the exposure information on their phones. The FCC could not help them, however. "Usually when people call, they ask about a certain model number," explained the FCC's **Kwok Chan**. "But, internally, we have no way to reference model numbers. We need the FCC ID number." The FCC's Dr. **Robert Cleveland** added that, "You have to dig through a lot of paperwork to get the number. We haven't put this into a database yet, so it takes someone a lot of time to find it." Chan told *Microwave News* that callers eventually will get answers.

• ***20/20*** also reported that four of the five phones that it had tested exceeded the FCC's exposure limit of 1.6 W/Kg in at least one test configuration. The Institute for Mobile and Satellite Radio Technology (**IMST**) in Kamp-Lintfort, Germany, measured each phone in two positions and, where appropriate, with the antenna both extended and retracted. All five phones were tested in analog mode. **Nokia**'s 6160, which *20/20* called "one of the top-selling phones in the country," had SARs of 1.84 to 2.16 W/Kg, while the Nokia 636, an older model, measured from 1.52 to 2.12 W/Kg. The SAR for **Ericsson**'s AH 618 was 1.34 W/Kg in one position, but 1.65 W/Kg in the other. One of two **Motorola** phones tested, the MicroTac Lite XL, ranged from 1.53 W/Kg with the antenna extended to as high as 3.15 W/Kg with it retracted. Only Motorola's StarTac measured below the FCC limit in all test configurations. Its highest SAR was 0.43 W/Kg.

• In a September 21 letter, CTIA President **Thomas Wheeler** urged the IEEE's **SCC-34** to "use all deliberate speed" to complete its protocol for measuring mobile phone SARs. FCC Chairman **William Kennard** made a similar plea earlier this year (see *MWN,* J/F99). **Howard Bassen** of the FDA told Wheeler on October 18 that his Subcommittee 2 (SC-2) of SCC-34 planned to finish a draft "soon after" its meeting scheduled for early December. Once SC-2 reaches an agreement, the FCC has said that it will issue its own revised testing rules for phone makers (see p.1).

• The **FCC** has purchased a DASY3 system from **Schmid & Partner Engineering** of Zurich so it can do its own SAR measurements. Among the Swiss firm's founders is Dr. **Niels Kuster** of the ETH in Zurich.

• In its September 22 issue, the Swiss consumer magazine ***K-Tip*** reported on tests in which the **Philips Genie 900** had an SAR of 2.67 W/Kg with the antenna retracted — the highest among the 25 mobile phones tested (see *MWN,* S/O99). An October 6 statement from Philips noted that the *K-Tip* SARs were averaged over 1 g of tissue (as required in the U.S.), not 10 g (as specified in Europe by CENELEC). For the larger averaging volume, the Dutch manufacturer stated, the Genie 900's SAR values are "substantially better" than the 2.0 W/Kg European limit. Philips added that, according to the **IMST**, which did the testing for *K-Tip,* "The Philips Genie is also compliant to the U.S. FCC guidelines," in which the maximum SAR is 1.6 W/Kg. Neither Philips nor the IMST responded to requests from *Microwave News* for clarification.

• Observers have long wondered how the handheld phones used in **Motorola**'s **Iridium** system can comply with SAR limits while communicating with satellites several hundred miles above the Earth. In June, appearing before the U.K. Parliamentary Select Committee on Science and Technology (see *MWN,* S/O99), Motorola's Dr. **Q. Balzano** offered this explanation: "Cellular phones on the ground have to communicate around the area. With cellular phones and satellites, the energy goes straight up; otherwise, you do not make the link. The antenna is completely above the head of the user and the energy is propagating upwards, so the exposure is even lower than the levels you encounter in the terrestrial cellular phones."

CTIA and FDA Unveil Narrow Research Pact as TV Report Airs

The Food and Drug Administration (FDA) announced on October 20 that it intends to form a partnership with the wireless industry to sponsor future safety research. The announcement came the same day that ABC's *20/20* broadcast a special report on mobile phone safety.

After months of informal discussions, the FDA and the Cellular Telecommunications Industry Association (CTIA) signed a formal letter of intent on October 18. It calls for follow-up research on two topics stemming from the CTIA-funded Wireless Technology Research (WTR) program: the finding of genetic damage in *in vitro* tests with the micronucleus assay (see *MWN,* M/A99) and results of WTR's epidemiology studies (see p.5 and *MWN,* M/J99). The letter provides a framework for negotiating a Cooperative Research and Development Agreement (CRADA).

Dr. Russell Owen of FDA's Center for Devices and Radiological Health in Rockville, MD, told *Microwave News* that he hopes that the CRADA will provide "a foundation for future collaboration" on additional research topics. In the past, the FDA has called for many other kinds of wireless health studies, citing animal studies as the top priority (see *MWN,* M/A97). Owen said, however, that the letter of intent does not reflect any narrowing of the FDA's views. "The CTIA has not expressed an interest in pursuing animal studies," Owen explained, adding, "We do not have a legal mechanism to force research."

The accord represents a shift from 1993, when the FDA rejected the limited role it was offered in the CTIA's research program on the grounds that it would not give the agency sufficient control (see *MWN,* J/A93; also J/F93 and S/O93).

When its funding of WTR came to an end in mid-1999, the CTIA made a general pledge to continue supporting research (see *MWN,* J/A99). Signing the letter of intent with the FDA is the first specific step it has taken in that direction. According to the letter, requests for proposals will be issued by the CTIA, which will "directly administer the funding of the research." The FDA "will make recommendations on proposal selection."

The CTIA and the FDA decided at the last minute to cancel a jointly sponsored conference on future research needs, which would have taken place one week before the ABC broadcast (see *MWN,* S/O99). Owen said the meeting will be rescheduled.

The report by *20/20* featured exposure measurements for several cellular phones, four of which exceeded the FCC's radiation limits under certain conditions (see p.6 and *MWN,* S/O99). All U.S. labs approached by ABC refused to conduct the tests if the phones' manufacturers were going to be named on TV, and the network ended up hiring a testing lab in Germany.

Those interviewed on the program included Drs. Ross Adey, George Carlo, Lennart Hardell, Martin Meltz and Louis Slesin, as well as Richard Branson, David Reynard and Tom Wheeler. The FDA refused to have any representatives appear on camera.

The next day the FCC promised to give "close scrutiny" to ABC's assertion that some phones violated exposure regulations. "Whether these phones are not in compliance with our limits remains to be determined, since variability in evaluation procedures is often an issue," the FCC stated. "We renew our call for the standard-setting committees to develop specific uniform procedures." If this is not done soon, it added, the FCC "will mandate action on its own" (see also p.1).

There was some drama and maneuvering in the days before *20/20*'s report. CTIA lawyer Andrew Copenhaver wrote to ABC on October 11, urging that the show not be broadcast until it was changed to make it acceptable to the industry group. Copenhaver, of the Washington firm of Womble, Carlyle, Sandridge & Rice, had won a multimillion dollar judgment against ABC for the Food Lion grocery chain, after the network used hidden cameras in an attempt to document the sale of spoiled meat.

On October 7, WTR's Carlo wrote to each member of the CTIA board, stating that he is "extremely frustrated and concerned that appropriate steps have not been taken by the wireless industry to protect consumers." Carlo asked for their help in distributing a consumer information packet on wireless safety, which his Health Risk Management Group is selling for $19.95.

On the day of the broadcast, the FDA posted a new consumer advisory on its Web site, at <www.fda.gov/cdrh/ocd/mobilphone.html>. It repeats advice the agency has given since 1993, stating that there is no definite proof that cellular phones are harmful or that they are safe. One new point is a call for the industry to "design mobile phones in a way that minimizes...RF exposure to the user."

Expert Panel To Consider Navy Radar's Environmental Impact

A panel of experts will examine a long-simmering dispute between the U.S. Navy and the California Coastal Commission over health and environmental effects of a radar test facility. On December 14, the panel will tour the Navy's Surface Warfare Engineering Facility (SWEF), located next to a public beach in Port Hueneme, CA.

"We're in this situation because the Navy did not abide by the law," local activist Lee Quaintance said in an interview. "It should have done a report on the environmental effects of this facility, and it never did." Quaintance is on the board of the Beacon Foundation in Oxnard, CA, a coastal-protection group.

Jean Schick, a public affairs officer with the Navy in Port Hueneme, told *Microwave News* that, "The panel is unbiased and qualified to review the information."

The panel members are: Dr. Ross Adey of the University of California, Riverside; Dr. Robert Beason of the State University of New York, Geneseo; Dr. John D'Andrea of the Naval Medical Research Institute at Brooks Air Force Base in San Antonio; Dr. Joseph Elder of the Environmental Protection Agency (EPA) in Research Triangle Park, NC; and Edwin Mantiply of the EPA in Montgomery, AL. The Coastal Commission appointed Quaintance as a citizen observer.

Completed in 1985, SWEF first came under public scrutiny in 1993 when the Navy sought permission for low-level jet flybys during radar testing. The Navy dropped the idea in the face of public opposition, but by then residents had become concerned about the radar facility itself. They had uncovered a 1978 Navy

preconstruction report stating that SWEF would have "significant environmental impacts," including "unavoidable" RF/MW emissions that would require "exclusion of the public from coastal recreation areas in violation of the California Coastal Act."

The Navy claimed that this report was only a draft, and that a thorough study of SWEF's environmental effects had found that there would be none. But when the Coastal Commission asked for the official environmental report in 1995, the Navy was unable to produce it. The Navy insisted that the study had in fact been filed, but finally admitted in 1997 that "no environmental documentation was found" during a yearlong search. The report "may have been done, it may not have been done — I don't know," Capt. J.W. Phillips told the commission in January 1999. "We looked for it and we just can't find it."

The Navy has continued to maintain that there are no environmental effects from SWEF, and in 1998 the Coastal Commission asked for informal mediation from the federal Office of Ocean and Coastal Resource Management, which then convened the expert panel. The Navy initially objected to Adey's participation, contending that his expertise was mainly with low frequency radiation, but it later withdrew this objection.

Panel members will issue individual reports, and are expected to do so within a few weeks of their December 14 tour of SWEF.

New Canadian RF/MW Standard Includes Voluntary Eye Limits

The new revision of Safety Code 6, Canada's RF/MW standard, establishes guidelines for exposure of the eyes of 0.2 W/Kg for the public and 0.4 W/Kg for workers.

"It is suggested" that specific absorption rates (SARs) be kept below these levels "whenever possible," states Safety Code 6, which was released by Health Canada on October 12.

The new Safety Code 6 otherwise follows the ANSI/IEEE and ICNIRP standards: SARs of 0.08 W/Kg and 0.4 W/Kg for whole-body exposures of the public and of workers, respectively. These limits correspond to 200 $\mu W/cm^2$ for the public and 1,000 $\mu W/cm^2$ for workers in the strictest frequency band, from 30 to 300 MHz. For exposures of the head and neck, the maximum SARs are 1.6 W/Kg for the public and 8 W/Kg for workers, averaged over 1 g of tissue. Unlike the guidelines on eye exposures, these limits are mandatory.

A draft of the revised standard had included mandatory limits for eye exposures (see *MWN,* S/O98). In the wake of opposition from industry — including a warning from a Canadian manufacturers group that many walkie-talkies would not comply with the limits — a voluntary approach was chosen.

Last spring, an expert panel appointed by the Royal Society of Canada recommended an interim limit of 1.6 W/Kg for eye exposures on the job (see *MWN,* M/J99).

Health Canada's Radiation Protection Bureau (RPB) had included eye exposure limits in its previous revision of Safety Code 6, in 1991. But transmitters operating below 7 W, including walkie-talkies and mobile phones, were exempt from this standard (see *MWN,* S/O87 and J/A91). In its new revision, Health Canada eliminated the exemption for many low-power devices.

The new Safety Code 6 states that the eye guidelines "shall remain valid until sufficient scientific information is available to accurately assess the health effects of RF exposure on the eye."

The full text of Safety Code 6 is available as a PDF file on the RPB's Web site at <www.hc-sc.gc.ca/rpb>.

Safety Code 6 applies directly only to Canada's federal employees. But Industry Canada, which sets SAR limits for manufacturers of wireless devices, bases its rules on Safety Code 6, making it in effect a legally binding public exposure standard.

On September 25, Industry Canada issued revised rules for compliance testing of portable RF/MW devices. SAR testing is now required for portable devices that operate at frequencies below 1 GHz with an output power exceeding 200 mW, or between 1 and 2.2 GHz with an output power greater than 100 mW. Industry Canada has also instructed manufacturers to make the results of their SAR tests available on request.

Swiss Study Finds GSM Phone Radiation Affects Sleep

Changes in sleep patterns caused by GSM phone radiation indicate that "mobile phones can influence the brain," according to a study at the Neuroscience Center Zurich (NCZ) in Switzerland. But the new results do not show that mobile phone use is dangerous, an NCZ statement stressed.

Mobile phone signals can "promote sleep" in some circumstances, conclude Drs. Alexander Borbély, Peter Achermann and colleagues in the November *Neuroscience Letters (275,* pp.207-210). Volunteers exposed to a GSM mobile phone signal spent less time awake after they first fell asleep, and also showed significant changes in their electroencephalograms (EEGs).

"We do not know the neurophysiological mechanisms leading to the effect," Achermann told *Microwave News*. GSM exposure altered the subjects' EEGs, with signals as much as 15% stronger in some frequencies. In size, Achermann noted, this is "comparable to the rise induced by...melatonin." This increase was prominent in a frequency band related to "sleep spindles," a type of EEG signal characteristic of one stage of deep sleep.

The paper points out that this effect was produced with specific absorption rates (SARs) "in the range of the exposure [experienced] during the use of mobile phones."

"The Borbély group is well-known in the field for its very thorough analysis of sleep stages," Dr. Boris Pasche of the Memorial Sloan-Kettering Cancer Center in New York City said in an interview. "Its results confirm that you can affect EEG activity with an RF field." The effect appears to be mild, Pasche said.

In the Borbély study, 24 men in their early 20s were exposed while they slept to an intermittent GSM signal — switched on or off every 15 minutes — with a maximum SAR of 1 W/Kg. The double-blind study involved two nights of observation one week apart. Volunteers were exposed to the signal in one session and sham-exposed in the other, with the order determined at random.

After volunteers fell asleep, the time they spent awake over the course of the night was reduced, on average, from 18 to 12 minutes. Of 24 volunteers, 17 showed a decrease in time awake.

This effect is statistically significant, but was only observed

when volunteers were exposed to the GSM signal during the first of the two sessions. If the sham exposure came first, no difference in time awake was seen. Borbély and colleagues theorize that the unfamiliarity of the experimental setup "seems to have caused a mild sleep disturbance" in the first session, which the GSM signal helped to overcome. They refer to studies of low-energy emission therapy (LEET), a technique pioneered by Pasche that uses RF signals to treat chronic insomnia (see *MWN,* M/J96). "As in the present study, the presence of sleep disturbance seemed to be a prerequisite for the [LEET] effect," the Swiss researchers write, citing their own unpublished research.

In contrast, EEG changes did not depend on the order of exposure. Signals were stronger among exposed volunteers, and significantly stronger for a wide range of frequencies. EEG changes did not fluctuate with the on-off cycle of the GSM signal, which "suggests that field exposure triggers a chain of events, rather than exerting a direct and immediate effect on sleep control," the paper states. EEG changes diminished over the course of the night, which "points to an adaptation mechanism."

Borbély's group saw no changes in the time needed to fall asleep (sleep latency), or in the length or sequence of the different stages of sleep. These findings are at odds with those of previous studies of sleep and GSM signals by Drs. Klaus Mann and Joachim Röschke of the University of Mainz in Germany (see *MWN,* M/J94 and M/J98). Also in contrast to Mann and Röschke, the Swiss researchers saw no EEG changes during REM sleep — the shorter, shallower part of the sleep cycle in which rapid eye movements and dreaming occur.

"It is difficult to say what accounts for the differences between the studies," commented Achermann, though he noted that there were some differences in the field conditions.

Borbély's study, which was funded by Swisscom and the Swiss National Science Foundation, is on the Web at <www.unizh.ch/phar/sleep/handy/>. The NCZ is affiliated with both the Federal Institute of Technology (ETH) and the University of Zurich, where Borbély and Achermann are based.

Russia and West Far Apart on RF/MW Standards *(continued from p.1)*

RF/MW thermal effects, Grigoriev said, while Russia's more restrictive standard also reflects a concern over nonthermal effects and subjective symptoms.

Grigoriev emphasized the need to take into account possible cumulative effects from repeated exposure to relatively low levels of radiation as well as the potential bioeffects of specific modulation patterns. "If we bring our viewpoints together, we will have a shorter way to harmonize," he said.

Dr. Michael Repacholi, director of WHO's International EMF Project in Geneva, urged the participants to "work together toward a common standard," arguing that, "We must have uniform standards because everyone should have the same high level of protection."

Asked later by *Microwave News* whether he envisioned adjusting U.S. and ICNIRP standards toward the considerably more stringent Russian standard, Repacholi replied that, "The WHO does not set standards. However, the WHO does support harmonized health standards based on valid science."

Repacholi did endorse the need for Western scientists to pay serious attention to the Russian standard. He explained that "the process of harmonization requires that everyone appreciate that there are many viewpoints on how standards should be set other than those now used in most Western countries."

In that regard, the meeting made some headway. For instance, Dr. James Lin of the University of Illinois, Chicago, said that he had benefited from hearing firsthand how Russian scientists go about standard setting. Before, he said, "I had heard rumors and harbored suspicions as to how things might have been done." Lin is chair of the National Council on Radiation Protection and Measurements (NCRP) committee that is revising the NCRP's 1986 RF/MW safety standard (see *MWN,* S/O95).

Lin observed that in order to reach any level of harmonization, efforts will need to be made to bridge the differences in basic philosophies behind standard setting. "Given the variability and the uncertainties in science, the different philosophical approaches make the situation very complicated," he said.

"I did not see much in the way of motion," cautioned Dr. Ben Greenebaum of the University of Wisconsin, Parkside, the editor of *Bioelectromagnetics*. "What is most discouraging is the fact that the Russians are still talking at us instead of with us."

Nevertheless, Greenebaum has some hope that the two sides will come together. "What I found most significant was the sense on the part of the Russian group that this harmonization of standards is really necessary," he commented.

The two sides will not reach common ground for some time. Dr. Jürgen Bernhardt, of Germany's Federal Office of Radiation

Public RF/MW Limits: Russia vs. ICNIRP

Frequency	Russia	ICNIRP
30 kHz-300 kHz	25 V/m	87 V/m
300 kHz-1 MHz	15 V/m	87 V/m
1-3 MHz	15 V/m	$87/\sqrt{f}$* V/m
3-10 MHz	10 V/m	$87/\sqrt{f}$* V/m
10-30 MHz	10 V/m (27 μW/cm^2)	200 μW/cm^2
30-300 MHz	3 V/m (2.4 μW/cm^2)	200 μW/cm^2
300-400 MHz	10 μW/cm^2†	200 μW/cm^2
400-2,000 MHz	10 μW/cm^2†	f*/200 μW/cm^2
2-300 GHz	10 μW/cm^2†	1,000 μW/cm^2

† 100 μW/cm^2 for exposures from TV or radio transmitters operating in a circular transmission or scanning mode.
* Frequency in MHz.

The "Special Importance" of Mobile Phones

More than 30 years ago, Soviet physicians first described microwave sickness, a condition among civilian and military personnel exposed to RF/MW radiation on the job.

Today, some of those same symptoms — fatigue, irritability, headaches, short-term memory loss and loss of libido — are being linked to the use of wireless hand-held telephones. But, as Drs. Yuri Dumansky and V.I. Datsenko of the Ukrainian Scientific Hygiene Center in Kiev pointed out in the abstract of the paper they prepared for the September Moscow conference, the data are still too limited to draw any firm connections.

"Special importance should be attached to this problem," advised Professor Yuri Grigoriev, the meeting's chief Russian organizer, pointing to the approximately 700 million people who are expected to be using mobile phones around the world within the next two years (see p.5).

Grigoriev wants more research on the possible long-term effects of RF/MW radiation on the brain. He stressed that in the studies carried out to date, volunteers have been exposed only for short time periods. "What happens to the users of mobile phones after two or three years of exposure?" he asked.

In a presentation, coauthored with Dr. L.P. Gulchenko, a colleague at the Institute of Biophysics in Moscow, Grigoriev cautioned that animal studies may be inappropriate for determining possible long-term health effects because they "do not correspond to real conditions of EMF exposure of the phone user."

Russian scientists, like those in other countries, are less worried about radiation from mobile phone base stations. A consensus statement, drafted by Grigoriev — with assistance from the WHO's Dr. Michael Repacholi and other attendees — and released at the conference, seeks to provide public reassurance about such towers. "EMF levels in public areas do not exceed existing maximum permissible levels contained in the Russian national standards," the statement reads. "Population safety is well protected by maximum permissible radiation levels. However, there is a lack of information provided to the public, causing fears for health and safety...."

Dr. A.V. Merkulov of the Russian Center of Electromagnetic Safety at the Institute of Biophysics told the Moscow participants that measurements conducted at a radius of 250 meters from 86 base stations found a maximum power level of 0.93 $\mu W/cm^2$ — less than one-tenth of Russia's strict 10 $\mu W/cm^2$ exposure limit (see table, p.9). He did not discuss power levels at closer distances.

Protection and the chair of ICNIRP, predicted that it will take "at least another three to four years to achieve harmonization of the standards." For now, he pointed to "the readiness of the responsible Russian scientists to participate in the harmonization process" as the most significant result of the Moscow meeting.

Repacholi, who chaired ICNIRP before Bernhardt, emphasized the need to educate the public about EMF safety issues and to counter health scare stories in the news media. "Public confidence will be reduced if they see experts arguing among themselves, going to meetings, debating, but then nothing is decided," he said.

Russia's official safety standard for general population exposure to RF/MW radiation — endorsed in May 1996 by a decree of the State Commission of Sanitary and Epidemiological Supervision — is 10 $\mu W/cm^2$ between 300 MHz and 300 GHz. In contrast, the ICNIRP and ANSI/IEEE voluntary standards vary with frequency in this part of the spectrum and can go as high as 1,000 $\mu W/cm^2$ (see table, p.9). Below 300 MHz, the Russian standard dips as low as 2.4 $\mu W/cm^2$, while the Western limits never drop below 200 $\mu W/cm^2$.

Dr. V.N. Nikitina of the Northwest Scientific Center of Hygiene and Public Health in St. Petersburg reviewed the history of Soviet and Russian electromagnetic radiation safety standards. She noted that maximum permissible exposures were set below assumed bioeffects threshold levels by a safety factor of five for frequencies up to 300 MHz and by a factor of ten above 300 MHz.

Nikitina pointed out that these standards were based on the belief that there is a threshold for health effects, but that clinical studies conducted since the 1980s undermine the validity of this assumption. "The threshold concept appears to require reconsideration," she said.

Other areas covered during the Moscow conference included experimental studies of mechanisms of EMF interaction, RF/MW effects on the blood-brain barrier (BBB), changes in the immune status of video display terminal (VDT) operators and cancer risks for workers exposed to power frequency fields, as well as clinical applications of EMF therapeutic devices.

The USAF sent five staffers to Moscow, led by Dr. Michael Murphy of Brooks Air Force Base in San Antonio. Other members of the USAF delegation included Dr. Eleanor Adair, who spoke on thermal physiological responses to RF/MW radiation, and James Merritt, who addressed leakage through the BBB.

Ukrainian scientist Dr. O.N. Chernysheva of the Research Institute of Labor Hygiene and Occupational Diseases in Kharkov presented findings from a comparative study of VDT operators and personnel occupationally exposed to RF/MW radiation. Elevated white blood cell counts were found in both groups, she said.

The part of the conference dealing with EMF devices used in medical treatment included eight papers, six of them by Russian scientists. This session was chaired by two Americans, Douglas Williams and Dr. Marko Markov, whose company, EMF Therapeutics Inc. of Chattanooga, TN, has undertaken a pilot study using a 120 Hz pulsating magnetic field to inhibit the blood supply to tumors.

Editor's Note

In our last issue, we wrote that the Chinese RF/MW exposure standard for the general population is the strictest anywhere. In fact, while the Russian and Chinese limits are the same above 300 MHz, between 30 and 300 MHz, the Russian standard is more stringent — 3 V/m, compared to 5 V/m in China.

said, the outer ear "is not a vital organ": Its main function is simply "to capture sound for hearing." Thus, it is not necessary to "protect the [outer ear] against RF exposure at the same level as the brain," Santomaa told SCC-28/SC-4. If the limit for the ear is raised, Santomaa argued, "Maximum power of phones will not be limited unnecessarily."

The members of SC-4 gave unanimous support to the proposed change, Chou and Petersen told *Microwave News*.

The IEEE's RF/MW standard limits most of the body to exposures of 1.6 W/Kg, averaged over 1 g of tissue. Exposures of the extremities can be as high as 4 W/Kg, averaged over a much greater 10 g. The IEEE standard has been adopted by the American National Standards Institute (ANSI). The Federal Communications Commission's (FCC) regulations are based on both the ANSI/IEEE guidelines and those of the National Council on Radiation Protection and Measurements.

It will be "at least six months" before the IEEE officially approves the higher exposure for the ear, Petersen said. But SC-4's vote may have an immediate impact on the design of testing procedures for cellular phones.

"It'll make it a lot easier to test for compliance if you don't have to worry about the ear," the FCC's Dr. Robert Cleveland said in an interview. Soon after the Atlanta meeting, Cleveland issued a memo proposing that a realistic ear not be included in the head models used for compliance testing, "due to a recent advisory opinion from the IEEE SCC-28/SC-4."

Reclassifying the ear as an extremity would eliminate a sticky problem for manufacturers: A recent study indicates that many phones now on the market do not comply with the FCC's exposure limits because of high exposures in the ear.

Using both experimental measurements and computer modeling, Dr. Om Gandhi of the University of Utah, Salt Lake City, tested ten mobile phones — five analog and five PCS digital models. While all five PCS phones met current standards, four of the five analog units had specific absorption rates (SARs) in the ear that exceeded the FCC's 1.6 W/Kg limit. Gandhi told the International Union of Radio Science's (known as URSI) meeting in Toronto on August 17 that the SAR in the ear was at least twice as high as allowed by the FCC for three of the analog phones, with one phone's SAR as high as 5.4 W/Kg, averaged over 1 g. Gandhi detailed his measurements in the August *IEEE Transactions on Electromagnetic Compatibility* (see *MWN,* S/O99).

All ten phones received FCC approval, Gandhi noted, because the agency allows testing with a plastic spacer instead of a realistic, radiation-absorbing model of the ear. "An earless model with a 4-6 mm thick plastic spacer underestimates the peak...SAR down to 40%-60% of the actual SAR," Gandhi wrote. Gandhi did not respond to requests for comment.

The IEEE subcommittee that is developing mobile phone testing protocols, SCC-34/SC-2, met in September and established an ear issue task force. Its members include Santomaa and Cleveland, with Chou as its chair. In an October 14 e-mail, Chou underlined the importance of reclassifying the ear for decisions on compliance testing: "About the ear discussion for SCC-34," he wrote, "since the outcome of SCC-28/SC-4 on October 17 will influence our decision, I prefer to wait until [that] meeting is over and then we will decide which way to go."

At the SCC-28/SC-4 meeting in Atlanta, Chou then proposed reclassifying the ear. Santomaa stressed that "passing of this motion will help SCC-34" in developing a measurement protocol. Petersen and Robert Curtis, of the Occupational Safety and Health Administration (OSHA) in Salt Lake City, were both willing to support the change, but they cautioned that this was not a valid reason. "The purpose of SCC-28 is to set the limits, not help with how measurements are done," Petersen told *Microwave News*. "Any change has to be based on the biological effects."

"There were some people in the beginning who thought this could be done just as an interpretation of the existing standard," Petersen added. "But the standard doesn't mention anything about this, so it does require a formal vote to change it," with mail ballots by both SC-4 and SCC-28 as a whole, and a vote by the IEEE standards board no earlier than June.

But SCC-34/SC-2 may decide not to wait. It is under pressure to act soon from both industry and the FCC, which have expressed concern that it is taking too long to agree on a standardized measurement procedure (see p.6 and *MWN,* J/F99). "We would like to make a decision on the ear issue at our meeting in Washington in December," said SCC-34/SC-2 chair Howard Bassen, of the Food and Drug Administration in Rockville, MD. In an interview, Bassen said that a proposal from the ear issue task force will be considered at the December 6-7 meeting.

Chou told *Microwave News* that SCC-28/SC-4's vote on the ear was a "decision [that] is important in resolving a controversial issue in SCC-34/SC-2." But Petersen was more doubtful. "I'm not sure it's going to help SCC-34," he said. "It would be difficult to base a decision on something that hasn't been approved yet, because there is always a risk that it won't end up being approved."

The FCC's Cleveland seems inclined to move ahead. "We could make a tentative conclusion that we can ignore the ear and proceed on the assumption that this change is going to happen," he said. "But having the data is a critical part of that." Cleveland's October 29 memo asks SC-4 members to document that absorption in the ear could never exceed the 4 W/Kg level allowed for the extremities as long as the SAR in the head meets the existing ANSI/IEEE standard. (It is not clear if the SAR that Gandhi measured at 5.4 W/Kg would fall below this limit when averaged over 10 g.)

As soon as SCC-34/SC-2 makes its key decisions, the FCC wants to use them as the basis for revising its own certification procedures. The FCC's new procedures were supposed to be issued almost a year ago (see *MWN,* J/F99).

The ear can take the higher exposures without any risk, argue supporters of the change. Even a 4 W/Kg exposure would cause a temperature increase in the ear of less than 1°C, Chou told SC-4. Santomaa asserted that such RF heating would be far less than the heating of the ear from the phone's circuitry, which warms up when it is in use.

"I'm not really worried about people having their ear exposed," Cleveland told *Microwave News,* echoing remarks by the FCC's Kwok Chan in September. "The ear can take a lot of abuse," Chan told the trade paper *RCR* (see *MWN,* S/O99). For his part, Petersen observed that, "The ear has really good cooling, if heating is the concern."

Hot New Papers

David Blask et al., "Melatonin Inhibition of Cancer Growth *in Vivo* Involves Suppression of Tumor Fatty Acid Metabolism via Melatonin Receptor-Mediated Signal Transduction Events," *Cancer Research, 59,* pp.4,693-4,701, September 15, 1999.

"Here, we describe a novel interface between two seemingly unrelated environmental factors that affect the regulation of tumor growth, namely, dietary fat, as represented by LA [linoleic acid], and information about the light/dark cycle, as conveyed by the melatonin signal. The discovery of this interaction forms the basis for a new understanding and integration of widely spread systemic, cellular and molecular metabolic pathways with the environmental influences of dietary fat, the photoperiod and the circadian system in the maintenance of the host-cancer balance. We believe these results provide a scientific rationale for the development of new dietary recommendations that consider LA intake, circadian-timed melatonin supplementation and/or photoperiodic alterations for the prevention and treatment of a variety of cancers."

Jiri Silny, "Electrical Hypersensitivity in Humans—Fact or Fiction?" *Zentralblatt für Hygiene und Umweltmedizin, 202,* pp.219-233, August 1999.

"The phenomenon of electrical hypersensitivity cannot be explained by the known mechanisms of [EMFs] in humans, as the thresholds of such effects are several decades higher than the field strengths in most of the living areas. Moreover, there is no evidence for significant effects in the weak fields, an adequate sensitization process is not known. If the phenomenon of electrical hypersensitivity should turn out real, then it would take intense research to investigate the acting behind it."

Martin Blank and Reba Goodman, "Electromagnetic Fields May Act Directly on DNA," *Journal of Cellular Biochemistry, 75,* pp.369-374, December 1999.

"Significant differences between the magnetic field-activated stress response and other forms of activation suggest that the conventional stress-activated signal transduction pathways may not necessarily be the only mechanisms for extracellular signaling to the nucleus.... [S]everal lines of evidence support a direct effect of magnetic fields on DNA through interaction with conducting electrons in the DNA. Since cells are minimally perturbed during magnetic field activation of the stress response, magnetic field stimulation could provide a unique experimental tool to study the steps involved in cellular activation mechanisms."

Lise Loberg, James Gauger, James Buthod, William Engdahl and David McCormick, "Gene Expression in Human Breast Epithelial Cells Exposed to 60 Hz Magnetic Fields," *Carcinogenesis, 20,* pp.1,633-1,636, August 1999.

"HBL-100 cells and normal (nontransformed) human mammary epithelial [HME] cells were exposed to [pure, linearly polarized 60 Hz] EMF flux densities of 0.1, 1.0 and 10.0 G for periods ranging from 20 min to 24 h....No patterns of statistically significant EMF effects on any gene were seen in either cell system....At 100 mG, a 32% increase in *c-fos* was seen in HME cells; no other effects were seen in HME cells, and the expression of all assayed genes in HBL-100 cells was comparable with sham control. The increase in *c-fos* expression in HME cells exposed to 100 mG EMFs is notable, since *c-fos* is a breast cancer-associated oncogene whose induction by EMFs has been reported in other *in vitro* systems. However, the small magnitude of this increase, when considered with the lack of induction of *c-fos* in cells exposed to EMFs at the higher flux density (10 G), appears to limit the biological significance of this finding. The results of the present studies demonstrate that exposure to EMFs has no statistically significant effects on the expression of *c-myc* and a battery of other cancer-related genes in two *in vitro* human breast epithelial cell model systems. These results supplement a growing body of evidence which suggests that alterations in oncogene or tumor suppressor gene expression are unlikely to be involved in a mechanism of EMF-induced cancer."

Childhood Leukemia: A Two-Step Process

J.L. Wiemels et al. (including M.F. Greaves), "Prenatal Origin of Acute Lymphoblastic Leukemia in Children," *Lancet, 354,* pp.1,499-1,503, October 30, 1999.

"Our findings showed that childhood acute lymphoblastic leukemia is frequently initiated by a chromosome translocation event *in utero*. Studies in identical twins show, however, that such an event is insufficient for clinical leukemia and that a postnatal promotional event is also required."

C. Robinson, M. Petersen and S. Palu, "Mortality Patterns Among Electrical Workers Employed in the U.S. Construction Industry, 1982-1987," *American Journal of Industrial Medicine, 36,* pp.630-637, December 1999.

"Our study of construction site electrical workers found a striking excess of risk for electrocution at work; modest excesses for brain tumors, leukemia, melanoma skin cancer, prostate cancer and asbestos-related illnesses — lung cancer, mesothelioma and asbestosis; and unexpected moderate excesses of suicide, musculoskeletal disease, prostate cancer and disorders of the blood-forming organs. Many of the excesses suggest or are consistent with an occupational etiology."

Eraldo Occhetta et al., "Implantable Cardioverter Defibrillators and Cellular Telephones: Is There Any Interference?" *PACE, 22,* pp.983-989, July 1999.

"The aim of our study was to consider cellular telephone interference using different cellular telephones and implantable cardioverter defibrillator (ICD) models. Thirty (26 men, 4 women) patients with ICDs were considered....Present ICD models seem to be well protected from electromagnetic interference caused by European cellular telephones (TACS and GSM), without under/oversensing of ventricular arrhythmias. However, cellular telephones disturb telemetry when located near the programming head. ICD patients should not be advised against the use of cellular telephones, but it has to be avoided during ICD interrogation and programming." (See also p.17.)

J.-L. Chagnaud, J.-M. Moreau and B. Veyret, "No Effect of Short-Term Exposure to GSM-Modulated Low-Power Microwaves on Benzo(*a*)pyrene [B(*a*)P]-Induced Tumors in Rats," *International Journal of Radiation Biology, 75,* pp.1,251-1,256, October 1999.

"The results presented here indicate that under our conditions of low-level exposure, GSM-modulated MW do not effect the development of sarcomas in rats treated with B(*a*)P. The incident power levels used in this study are close to the reference levels that correspond to the basic restrictions which are almost universally accepted: 0.08 and 0.4 W/Kg for the public and workers, respectively. Comparison of our results with other studies is difficult because of the difference in animal cancer models used (strains of animals, carcinogen, type of tumor) and the conditions of exposure." (See *MWN,* J/A99.)

Charles Graham et al., "Human Exposure to 60 Hz Magnetic Fields: Neurophysiological Effects," *International Journal of Psychophysiology, 33,* pp.169-175, August 1999.

"The neurophysiological effects of exposure to power frequency magnetic fields at two occupationally relevant intensities [14.1 and 28.3 μT]

were evaluated in a single-blind study with 18 male and 18 female volunteers....Men and women showed a similar lack of sensitivity to exposure. The present results do not support the mechanistic hypothesis that the transmission of sensory information to appropriate cortical centers is delayed or distorted by exposure to power frequency magnetic fields at occupational intensities."

Dave Lamble et al., "Cognitive Load and Detection Thresholds in Car-Following Situations: Safety Implications for Using Mobile (Cellular) Telephones While Driving," ***Accident Analysis and Prevention, 31,*** **pp.617-623, November 1999.**

"The conclusion of the current study is that neither a hands-free phone option nor a voice-controlled interface removes the problem of driver performance impairment when using a mobile phone in the car. What is needed, as a minimum improvement, is an increase in road user education to make drivers aware of the risks involved with using phones whilst driving even with a hands-free option. Given the current level of mobile phone usage in vehicles, it is apparent that drivers are able to use a mobile phone while driving, but its use is an attention-demanding factor which is likely to contribute to a crash in a critical situation. The present and past experimental results, as compared to alcohol effects... and reported crashes where the responsible driver was distracted through the use of a mobile phone...imply that mobile phones in cars represent an unacceptable increase in the risk of having a crash." (See *MWN,* J/F 98.)

Xiao Ou Shu, Martha Linet et al. (including Leslie Robison), "Breast-Feeding and Risk of Childhood Acute Leukemia," ***Journal of the National Cancer Institute, 91,*** **pp.1,765-1,772, October 20, 1999.**

"Ever having breast-fed was found to be associated with a 21% reduction in risk of childhood acute leukemias (odds ratio (OR) for all types combined=0.79; 95% confidence interval (CI)=0.70-0.91). A reduction in risk was seen separately for AML [acute myeloid leukemia] (OR=0.77; 95% CI=0.57-1.03) and ALL [acute lymphoblastic leukemia] (OR=0.80; 95% CI=0.69-0.93). The inverse associations were stronger with longer duration of breast-feeding for total ALL and AML....Biologically plausible mechanisms that may underlie the relationship between breast-feeding and risk of childhood acute leukemia include anti-infective and/or immune-stimulatory and immune-modulating effects."

Across the Spectrum

Last words: Though there are no proven biological dangers of cell phones, when you have a choice, why not use a regular phone? You can also buy an inexpensive cell phone headset, so the phone can stay in your purse or pocket while you talk.

— "Cell Phones vs. Brain Cells?"
UC Berkeley Wellness Letter, **p.3, October 1999**

More than half were under the impression that living near electricity pylons increased cancer risk, when this has never been proven.

— Richard Hannaford on the results of a 1,000-person survey, in "Public Gripped by Cancer Myths,"
BBC Online Network, **<news.bbc.co.uk>, October 11, 1999**

Regulatory oversight of wireless technology in the U.S. is at best weak and ineffectual and at worst an illusion. The FCC is only now beginning to look at in-field testing of phones in use, a necessary policing step. The FDA seems unable to make a move unless there is absolute proof of harm to the public, and the bizarre notion of a collaborative financial relationship with the industry it is supposed to be regulating is beyond belief in its blatant conflict of interest....

— Dr. George Carlo, chair, WTR, Washington, in a letter to the editor, ***Wireless Week,*** **p.4, November 1, 1999**

"No matter how remote the risk may be, we want to make customers aware that they are putting themselves at some risk if they are speaking on a cell phone or operating a pager or any other electronic device in the proximity of flammable liquids."

— Howard Miller, spokesperson, BP Amoco, quoted by Katie Hafner in "Safety Fears Will Discourage Cell Phone Use at Gas Pumps,"
New York Times, **p.G3, October 14, 1999**

It all starts with this radar antenna, ten stories in the air. The steel behemoth, shaped like a jai alai cesta and painted red and white, rises from a concrete tower and lords over an abandoned, weed-choked military base at the easternmost tip of Long Island. From this radar dish [at the Montauk Air Force Station] came the deadly rays that altered thoughts, that ripped a hole in the time-space continuum, that fired the particle beam that shot down all the airplanes. Or so go the conspiracy theories. Over the last three years, a handful of airplanes have crashed into the Atlantic not far from here: TWA 800, Swissair 111, John F. Kennedy Jr.'s Piper and now EgyptAir 990....The [Montauk] base closed in 1981 and has been empty since....

— Frank Ahrens, "Flight into the Space-Time Continuum: EgyptAir Crash Fuels Conspiracy Buffs' 'Montauk Project' Myth,"
Washington Post, **p.C1, November 6, 1999**

"Motorola was adamant that Adey never mention DNA damage and RF radiation in the same breath."

— Dr. Jerry Phillips, Colorado Springs, CO, formerly a member of Dr. Ross Adey's lab at the VA Hospital, Loma Linda, CA, quoted by Gordon Bass in "Radar: Is Your Cell Phone Killing You?"
PC Computing, **p.63, December 1999**

[T]here is no overwhelming wave of costly litigation in the EMF area today. One of the reasons is that despite many years of research on EMFs and their risks, there is no certain consistency in the results of the studies. Claimants do not have unanimous scientific agreement of a causal relationship between EMFs and injuries. What claimants do have, and what should cause concern to insureds and insurers, is the public perception that EMFs are harmful. Public fear that EMFs cause cancer and other ailments can affect the outcome of a lawsuit.

— David Thamann, "EMF Claims Could Still Overwhelm Insurers,"
National Underwriter, **p.6, November 8, 1999**

We will soon be bombarding the universe with more radio and infrared emissions than ever before.

— Peter Lewis, on the introduction of wireless networking of computers and other consumer electronics devices, in "Not Born To Be Wired,"
New York Times, **Circuits, p.3, November 25, 1999**

Brain Cancer Causes Cell Phones, a new comedy, is an examination of the creative process in a technology and media dominated society fast approaching a new millennium — blah, blah, blah — you get the point....

— Announcement for *Brain Cancer Causes Cell Phones*, "an explosive new sketch-play" at the Gene Frankel Theater, New York City, running December 3-19, 1999

International Workshop on Mobile Phones and Brain Cancer

The International Workshop on Mobile Phone Use and Adult Brain, Head and Neck Tumors, *held at the German Cancer Research Center in Heidelberg, November 12-13, brought together researchers from around the world. Dr. Joachim Schüz of the University of Mainz's Institute for Medical Statistics and Documentation, who presented a paper at the meeting, filed this report for* Microwave News.

Professors Maria Blettner of the University of Bielefeld, Jörg Michaelis of the University of Mainz and Jürgen Wahrendorf of the German Cancer Research Center organized the workshop to review the results of their feasibility study for a large-scale epidemiological study on the possible association between the use of mobile phones and cancer in Germany.

The German study group was seeking assistance in answering two central questions: (1) Are case-control and cohort studies feasible under conditions that are relevant to the German experience? and (2) Should exposure to RF/MW from mobile phone base stations be included in such studies? With the help of a group of invited international experts, a number of methodological issues that could impact risk estimates were covered, including sources of selection bias and the effects of exposure misclassification and confounding factors.

Sweden's Dr. Lennart Hardell and the U.S.'s Joshua Muscat described the results of their completed case-control studies, both of which indicate no overall increase in brain tumor risk associated with the use of mobile phones [see *MWN,* M/J99]. Their findings for subgroups are inconclusive due to the small numbers of subjects. In both studies, GSM, the digital mobile phone system commonly used in Germany, played only a minor role.

Further insights were drawn from talks by Dr. Elisabeth Cardis on the planned multicountry, case-control study coordinated by the International Agency for Research on Cancer (IARC) in Lyon, France [see *MWN,* J/F98 and S/O98], by Dr. Kenneth Rothman of Epidemiology Resources Inc. in Newton Lower Falls, MA, on a promising U.S. cohort study that came to an abrupt end [see p.5 and *MWN,* M/J96 and N/D97] and by Dr. Christoffer Johansen on the ongoing cohort study at the Danish Cancer Registry in Copenhagen [see *MWN,* M/J99]. In each case, there was extended debate on the controversial problem of the relatively short latency period that has elapsed since the widespread introduction of mobile phones.

The German feasibility study indicates that Bielefeld, Heidelberg and Mainz — each city has a large neurosurgical clinic — would make up a reasonable study area and that a sufficiently high response rate could be expected. The use of mobile phones in Germany has been historically low, however. It has only increased over the last few years and, at present, includes 23% of the German population. This prompted the suggestion that the German part of the IARC study be expanded to achieve independent, meaningful results for the German population.

There was a further suggestion to undertake cohort studies to complement the planned case-control studies in order to include a greater number of possible outcomes. There was agreement that cohorts should be large enough to allow internal comparisons between heavy and infrequent users of mobile phones, as previous studies indicated a lower overall mortality among mobile phone users.

During the discussions it became clear that the health concerns among the general public in Germany over microwave exposures from mobile phone base stations are more pronounced than in many other countries. RF/MW measurements in randomly selected locations in the city of Mainz show that the distance to a base station cannot be used to discriminate reliably between different levels of individual exposures. The observation that distance is a poor indicator of radiation exposure was supported by surveys by the U.K. National Radiological Protection Board.

The main conclusions of the Heidelberg workshop were:

• The German part of the IARC case-control study should include a larger sample size to achieve meaningful results for Germany alone.

• Prospective cohort studies should complement case-control studies. Protocols and preliminary budgets will be worked out for two cohorts: one for subjects already participating in a survey of almost 30,000 mobile phone users and one based on data from health insurers.

• Ecological studies near base stations are not recommended at the present time due to uncertainties over exposure assessment. The feasibility study will try to determine whether field strengths predicted by computer models developed by mobile carriers can be used for such studies.

Further details will be published in a workshop report. The other speakers at the workshop were: Drs. Angus Cook (New Zealand), Maria Feychting (Sweden) and Simon Mann (U.K.), as well as Dr. Gabriele Berg, Klaus Schlaefer and Dr. Brigitte Schlehofer of the German study group.

"MICROWAVE NEWS" FLASHBACK

Years 15 Ago

• Dr. Abe Liboff of Oakland University and the U.S. Navy's Dr. John Thomas find that rats exposed to a combination of 60 Hz and static magnetic fields display impaired timing discrimination. The result was predicted by a cyclotron resonance model.

• The WHO and IRPA (now ICNIRP) recommend keeping long-term EMF exposures "as low as can be reasonably achieved" until more is known about the biological effects of EMFs.

• The Johns Hopkins University (JHU) Applied Physics Lab adopts a "flat" 100 $\mu W/cm^2$ limit for exposures to 30 MHz-100 GHz.

Years 10 Ago

• A JHU team finds some telephone linemen have high rates of leukemia and other cancers. A male breast cancer cluster is also reported, the first time this disease is linked to EMFs.

• The Colorado Public Utilities Commission adopts a policy of "prudent avoidance" of EMF exposures from new power lines.

• "In response to an emerging customer requirement," IBM introduces VDTs shielded to reduce emissions of VLF magnetic fields.

Years 5 Ago

• Drs. Henry Lai and N.P. Singh of the University of Washington, Seattle, show that low-level 2450 MHz radiation can cause DNA breaks in the brains of live rats.

• Canada's Hydro-Québec (HQ) denies McGill University further access to its data, after HQ workers exposed to high frequency transients are found to have an increased risk of lung cancer.

• Nine months after President Bill Clinton said he would address EMFs and childhood cancer, the White House has yet to issue a statement on EMF health risks.

2000 Conference Calendar (Part I)

Part II will appear in our next issue.

January 10-13: **RF Safety: Science, Compliance and Communications,** Marriott Riverwalk, San Antonio, TX. Contact: Michelle Gutberlet, Electromagnetic Energy Association, 1255 23rd St., NW, Suite 200, Washington, DC 20037, (202) 452-1070, Fax: (202) 833-3636, E-mail: <eea@elecenergy.com>, Web: <www.elecenergy.com>.

January 23-27: **Winter Meeting of the IEEE Power Engineering Society (PES),** Singapore. Contact: IEEE PES, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855, (732) 562-3883, Fax: (732) 562-3881, E-mail: <peswm2000@ieee.org>, Web: <www.ieee.org/power>.

February 4: **Radiofrequencies and Modulations Applied in Wireless Communication: Biological Effects and Safety Concerns,** Catholic University of America, Washington, DC. Contact: Dr. Ewa Czerska, (301) 594-1212, ext.119, E-mail: <emc@cdrh.fda.gov> (see p.5).

February 28-March 1: **Wireless 2000,** Ernest Morial Convention Center, New Orleans, LA. Contact: CTIA, (202) 785-2842, Web: <www.wow-com.com/convsem/wireless/2000>.

March 1-3: **10th Annual DistribuTECH Conference and Exhibition,** Miami Beach Convention Center, Miami Beach, FL. Contact: DistribuTECH 2000, 1421 S. Sheridan Rd., Tulsa, OK 74112, (918) 831-9160, Fax: (918) 831-9161, E-mail: <distributech@pennwell.com>, Web: <www.distributech.com>.

March 20-22: **39th Annual Meeting of the Society of Toxicology (SOT),** Convention Center, Philadelphia, PA. Contact: SOT, 1767 Business Center Dr., Suite 302, Reston, VA 20190, (703) 438-3115, Fax: (703) 438-3113, E-mail: <clarissa@toxicology.org> , Web: <www.toxicology.org>.

April 1-7: **8th Scientific Meeting and Exhibition of the International Society for Magnetic Resonance in Medicine (ISMRM),** Convention Center, Denver, CO. Contact: ISMRM, 2118 Milvia St., Suite 201, Berkeley, CA 94704, (510) 841-1899, Fax: (510) 841-2340, E-mail: <info@ismrm.org>, Web: <www.ismrm.org>.

April 2-6: **2nd World Congress on Microwave and Radiofrequency Processing,** Renaissance Resort, Orlando, FL. Contact: David Clark, University of Florida, Dept. of Materials Science and Engineering, PO Box 116400, Gainesville, FL 32611, (352) 392-7660, Fax: (352) 846-2033, E-mail: <dclar@mse.ufl.edu>, Web: <www.acers.org/2WC>.

April 5-6: **36th Annual Meeting of the National Council on Radiation Protection and Measurements (NCRP),** Crystal City Marriott, Arlington, VA. Contact: NCRP, 7910 Woodmont Ave., Suite 800, Bethesda, MD 20814, (301) 657-2652, Fax: (301) 907-8768, Web: <www.ncrp.com>.

April 8-13: **31st Annual Meeting of the Environmental Mutagen Society,** Hyatt Regency Superdome, New Orleans, LA. Contact: Jim Tucker, Lawrence Livermore National Lab, BBR Program L-452, PO Box 808, 7000 East Ave., Livermore, CA 94551, (925) 423-8154, Fax: (925) 422-2282, E-mail: <tucker5@llnl.gov>, Web: <www.ems-us.org/meetings.html>.

April 9-13: **2000 International Magnetics Conference (Intermag 2000),** Royal York Hotel, Toronto, Canada. Contact: Courtesy Associates, 2000 L St., NW, Suite 710, Washington, DC 20036, (202) 973-8676, Fax: (202) 973-8722, E-mail: <intermag@courtesyassoc.com>, Web: <www.intermagconference.com>.

April 9-14: **Millennium Conference on Antennas and Propagation (AP 2000),** Davos, Switzerland. Contact: AP 2000 Secretariat, ESTEC Conference Bureau, PO Box 299, 2200 AG Noordwijk, The Netherlands, (31+71) 565-5005, Fax: (31+71) 565-5658, E-mail: <confburo@estec.esa.nl>, Web: <www.estec.esa.nl/AP2000>.

April 10-12: **62nd Annual Meeting of the American Power Conference,** Marriott Downtown, Chicago, IL. Contact: American Power Conference, Illinois Institute of Technology, 3310 S. State St., Chicago, IL 60616, (312) 567-3196, Fax: (312) 567-3892, E-mail: <apc@iit.edu>, Web: <apc.iit.edu>.

April 10-13: **National Association of Broadcasters Annual Convention (NAB 2000),** Las Vegas, NV. Contact: Kathy Muller, NAB, 1771 N St., NW, Washington, DC 20036, (202) 775-3527, Web: <www.nab.org/conventions>.

May 4-5: **Low Frequency EMF, Visible Light, Melatonin and Cancer,** Cologne, Germany. Contact: Thomas Erren, Institut und Poliklinik für Arbeits- und Sozialmedizin der Universität zu Köln, 50924 Köln, Germany, (49+221) 478-5819, Fax: (49+221) 478-5119, E-mail: <tim.erren@uni-koeln.de>.

May 7-12: **2000 IEEE Radar Conference,** Hilton Mark Center, Alexandria, VA. Contact: Jacquelyn Hunter, PO Box 220521, Chantilly, VA 20153, (703) 803-8701, Fax: (703) 222-3208, E-mail: <j.hunter@ieee.org>, Web: <www.ewh.ieee.org/soc/aess/radar2000>.

May 12-19: **American Occupational Health Conference (AOHC),** Convention Center, Philadelphia, PA. Contact: Nancy Olson, AOHC, 114 N. Arlington Heights Rd., Arlington Heights, IL 60004, (847) 818-1800, Fax: (847) 818-9266, E-mail <nolson@acoem.org>.

May 14-17: **32nd Annual National Conference on Radiation Control,** Hyatt Regency, Tampa, FL. Contact: Lin Carigan, Conference of Radiation Control Program Directors, 205 Capital Ave., Frankfort, KY 40601, (502) 227-4543, Fax: (502) 227-7862, E-mail: <lcarigan@crcpd.org>, Web: <www.crcpd.org/meetings.html>.

May 14-19: **Conference on Precision Electromagnetic Measurements (CPEM 2000),** Hilton Hotel, Sydney, Australia. Contact: CPEM 2000, GPO Box 128, Sydney, NSW 2001, Australia, (61+2) 9262-2277, Fax: (61+2) 9262-2323, E-mail: <cpem2000@tourhosts.com.au>, Web: <www.tourhosts.com.au/cpem2000>.

May 14-19: **International Radiation Protection Association International Congress 2000 (IRPA-10),** Hiroshima, Japan. Contact: IRPA-10 Secretariat, c/o Japan Convention Services Inc., Nippon Press Center, Building 4F 2-2-1, Uchisaiwai-cho, Chiyoda-ku, Tokyo 100, Japan, (81+3) 3508-1214, Fax: (81+3) 3508-0820, E-mail: <irpa@convention.co.jp>, Web: <www.convention.co.jp/irpa10>.

May 19-26: **American Industrial Hygiene Conference and Exposition,** Orange County Convention Center, Orlando, FL. Contact: American Industrial Hygiene Association, 2700 Prosperity Ave., Suite 250, Fairfax, VA 22031, (703) 849-8888, Fax: (703) 207-3561, E-mail: <cdavisjones@aiha.org>, Web: <www.aiha.org/conf.html>.

May 20-26: **IEEE International Conference on Phased Array Systems and Technology,** Marriott Laguna Cliffs Resort, Dana Point, CA. Contact: Dr. Michael Thorburn, Aerospace Corporation, PO Box 92957, M1/111, Los Angeles, CA 90009, (310) 336-2197, Fax: (310) 336-6225, E-mail: <m.a.thorburn@ieee.org>, Web: <www.ieeeaps.org/ISPAST00>.

May 22-26: **WHO/ICNIRP 4th International Non-Ionizing Radiation Workshop,** Kyoto, Japan. Contact: R. Matthes, Institut für Strahlenhygiene, Bundesamt für Strahlenschutz, Ingolstädter Landstraße 1, D-85764 Oberschleißheim, Germany, (49+89) 31603-288, Fax: (49+89) 31603-289, E-mail: <r.matthes@icnirp.de>, Web: <www.icnirp.de>.

May 29-June 2: **25th Annual Conference of the Australasian Radiation Protection Society (ARPS 25),** Millennium Hotel, Sydney, Australia. Contact: ARPS 25, Dr. Ron Cameron, Safety Division, ANSTO, Private Mail Bag 1, Menai, NSW 2234, Australia, Web: <www.arl.gov.au/arps>.

May 30-June 2: **2000 European Electromagnetics Conference (EUROEM 2000),** Edinburgh, U.K. Contact: EUROEM 2000, Concorde Services Ltd., Suite 325, Pentagon Business Center, Washington St., Glasgow G3 8AZ, U.K., (44+141) 221-5411, Fax: (44+141) 221-2411, E-mail: <euroem@concorde-uk.com>, Web: <www.mcs.dundee.ac.uk:8080/~euroem>.

June 7-10: **8th European Magnetic Materials and Applications Conference (EMMA 2000),** Kiev, Ukraine. Contact: EMMA 2000 Conference, Institute of Magnetism, 36-b, Acad. Vernadsky Blvd., 252142 Kiev, Ukraine, (380+44) 444-3420, Fax: (380+44) 444-1020, E-mail: <emma@imag.kiev.ua>, Web: <www.viaduk.net/freepage.nsf/page/emma2000>.

June 9-16: **22nd Annual Meeting of the Bioelectromagnetics Society (BEMS),** Technical University, Munich, Germany. Contact: Dr. William Wisecup, 7519 Ridge Rd., Frederick, MD 21702, (301) 663-4252, Fax: (301) 371-8955, E-mail: <75230.1222@compuserve.com>, Web: <www.bioelectromagnetics.org>.

June 11-16: **IEEE Microwave Theory and Techniques Society (MTT-S) International Microwave Symposium,** Boston, MA. Contact: LRW Associates, 6701 Bay Meadow Dr., Glen Burnie, MD 21060, (704) 841-1915, Fax: (704) 845-3078, E-mail: <lrwassoc@sprintmail.com>, Web: <www.ims2000.org>.

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UPDATES

EMP WEAPONS

New Warning Issued on Capitol Hill... At a congressional hearing on October 7, Reagan-era national security planners beat the drums for more spending on defenses against electromagnetic pulse (EMP) weapons. Rep. Curt Weldon (R-PA), chair of the House Armed Services Committee's subcommittee on R&D, said that the hearing was needed "to help educate the public on this still not widely understood threat." In the 1980s, the U.S. spent billions to protect its military systems against EMP effects, and remarks at the hearing were reminiscent of past warnings about a Soviet EMP threat (see *MWN,* Jun81, May82 and Sept84). This time, though, the chief villains are Third World regimes such as Iraq and North Korea. "Pyongyang may consider an EMP attack...the best way to blackmail or deter the U.S. in the event of a crisis," Weldon suggested in his opening remarks. Dr. William Graham of National Security Research Inc., science adviser to Reagan and former chair of a Pentagon committee on the "Star Wars" antimissile system, argued that a small nation might launch an EMP attack on the U.S. "simply to demonstrate that the nation had both functional nuclear weapons" and a way to deliver them. While there is no evidence that the U.S. has ever been targeted in this way, Dr. Lowell Wood of the Lawrence Livermore National Lab in California testified that, "It is widely known that we Americans contemplated, briefly and in a nonpervasive fashion, a nuclear EMP laydown on Iraq" as an opening salvo in the Gulf War. In 1992, there were reports that the U.S. had actually used a nonnuclear EMP device against Iraq — a high-power microwave weapon mounted on a Tomahawk missile (see *MWN,* M/J92 and S/O92). Nonnuclear EMP weapons can operate "more surgically, from distances [of up to] several hundred miles," corrupting electronic data or even "fusing or melting sensitive internal components," Graham testified. Wood warned that modern electronics are more vulnerable to EMP than are older systems, due to their smaller and more sensitive circuits. In contrast, Wood claimed that an EMP attack "doesn't damage the human body," and that "no physiological damage of any kind takes place." He said that a nuclear EMP attack would be the opposite of the popular image of the effects of the neutron bomb: Instead of killing people and leaving physical objects intact, it would destroy electronics but leave people unharmed. (Wood did not discuss possible health effects experienced by those exposed during EMP testing, such as Boeing engineer Robert Strom. Strom contracted leukemia and sued Boeing, winning a settlement of over $500,000; see *MWN,* S/O90, also S/O 88.) As for past efforts to protect military hardware against EMP, Wood — who currently holds a fellowship at the Hoover Institution in Stanford, CA — complained that their "average effectiveness was not exceedingly high." He blamed this on top officials who neither "really understood — or, in some cases, believed in the existence of — EMP and its effects." But he conceded that there had also been some technical problems: "In some notable EMP-hardening programs, sustained and strenuous efforts were made without securing desired results." Wood urged more spending on EMP-hardening efforts in the military, and, echoing the views of Dr. Edward Teller (see *MWN,* J/F83), also called for EMP-hardening of civilian communications and power facilities. Describing civilian infrastructure as "naked to our nuclear-

armed enemies," Wood asserted that, "Even a modest, single-explosion EMP attack on the U.S. might well devastate us as a modern, postindustrial nation." Dr. Michael Bernardin, who has worked on EMP and on offensive RF weapons at Los Alamos National Lab in New Mexico, spoke for the Clinton administration. He noted that in the most famous EMP incident, 30 strings of streetlights failed on the Hawaiian island of Oahu during a high-altitude nuclear test in 1962. While this was impressive, given that it occurred 800 miles from the blast site, it represented only 1% of all streetlights on the island. "Thus, the effects were not ubiquitous," said Bernardin. Careful computer modeling of EMP effects is needed, he added, "before predictions of catastrophic damage are to be believed."

MEDICAL DEVICE EMI

"Don't Lean, Don't Linger, Don't Worry"... A study of 169 people with implantable cardioverter defibrillators (ICDs) exposed to electronic antitheft systems found 19 instances of electromagnetic interference (EMI), according to a paper in the July 27 issue of *Circulation (100,* pp.387-392, 1999). A team led by Dr. Douglas Zipes of the Indiana University School of Medicine in Indianapolis reported that all the cases of EMI occurred during so-called "extreme exposure," in which ICD users stood for two minutes within six inches of one of the antitheft system's pillars (which are placed at store exits to detect removal of any merchandise with an antitheft tag still attached). "It does not appear that...systems pose a threat to patients with ICDs if exposure is kept to a 10- to 15-second...walk-through," Zipes concluded. "Don't lean, don't linger, don't worry!" was how Zipes summarized his advice for patients (see *MWN,* J/A99). In 12 of the 19 cases of EMI, Zipes judged that the interference was "not clinically relevant." But in the other seven instances, EMI might have caused the ICD to deliver an "inappropriate" electrical shock to the heart. (The shocking mechanism was turned off for this experiment.) These seven cases occurred with ICDs implanted in the abdomen — a procedure that is almost never used today. Thus, Zipes wrote, "The already minimal risk of [EMI] should diminish even more as older and abdominal ICDs are replaced with newer pectoral defibrillators." Zipes's paper called for signs to be posted when antitheft systems are hidden in walls or floors, an increasingly common situation. This idea was opposed last year by Dr. Warren Harthorne, a consultant for Sensormatic, a leading maker of antitheft devices based in Boca Raton, FL. "If you start placing signs in stores, you're going to have a rash of hysterical patients," Harthorne, of Massachusetts General Hospital in Boston, said at an FDA hearing (see *MWN,* S/O98). Sensormatic provided funding for Zipes's study, which examined only Sensormatic equipment. The three most serious cases of EMI in Zipes's study were caused by an acousto-magnetic system, a type made only by Sensormatic (see *MWN,* N/D98).

PEOPLE

Dr. **David Savitz** of the University of North Carolina, Chapel Hill, has been elected president of the Society for Epidemiologic Research. He takes the helm next June....**Janie Blanchard** has left Bechtel in San Francisco to join the Metropolitan Trans-

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portation Commission in Oakland, CA....Dr. **Alessandro Chiabrera** died on November 9. Chiabrera was at the University of Genoa in Italy and was an associate editor of *Bioelectromagnetics*....Dr. **John Goldsmith** of Ben-Gurion University of the Negev in Beer Sheva, Israel, died on October 21 after a long illness. He was formerly with the California Department of Health. In some of his last papers, Goldsmith argued in favor of a policy of prudent avoidance of RF exposures (see *MWN*, N/D97).

VIDEO DISPLAY TERMINALS

NIOSH Anthology...NIOSH has issued a new edition of its papers on VDTs and health. The volume features the controversial 1991 study, led by Dr. Teresa Schnorr, of VDT use and miscarriages among telephone operators (see *MWN*, M/A91). In the *New England Journal of Medicine*, Schnorr and coauthors concluded that, "[U]se of VDTs and exposure to the accompanying EMFs were not associated with an increased risk." NIOSH does not include letters that later appeared in the *Journal* (September 12, 1991), pointing out that the exposed and control groups worked in power frequency magnetic fields of nearly identical strengths (see *MWN*, S/O91). The book contains excerpts of Richard Tell's exposure assessment for the study. The 134-page collection also includes a 1997 paper on VDT use and low birth weight or preterm births. Many of the papers address office ergonomics. *NIOSH Publications on Video Display Terminals* (3rd edition) is available free of charge from: NIOSH Publications Dissemination (C-13), 4676 Columbia Parkway, Cincinnati, OH 45226, (800) 356-4674, Fax: (513) 533-8573, E-mail: <pubstaft@cdc.gov>, Web: <www.cdc.gov/niosh>.

Keeping Current: Follow-Up on the News

◆ The COST244bis workshop in Stockholm, December 12-13, was to address "Quality Assurance in EMF Epidemiology." But, possibly because of a glut of other meetings, the plans have changed. Those who show up will instead discuss the future of COST244.

◆ The U.K.'s Independent Expert Group on Mobile Phones (see *MWN*, S/O99) has its own Web site: <www.iegmp.org.uk>.

◆ The EMR Network, an umbrella group of activists fighting cellular towers, is looking to expand its support (see *MWN*, N/D 98 and M/A99). On November 17, it ran a quarter-page ad in the "Giving" section of the *New York Times* arguing that, "The wireless buildout should not continue until basic questions about safety are answered." The group reran the ad on the much more widely read Op-Ed page of the Sunday *Times* on November 28.

◆ There is "no definitive scientific evidence" of any public health hazard associated with radiation from the U.S. Air Force's PAVE PAWS missile defense radar on Cape Cod, concluded a panel appointed by the Massachusetts Department of Public Health in a report released on November 26 (see *MWN*, M/J87, J/A98 and N/D98). The full text of the report is available on the Internet at: <www.state.ma.us/dph/beha>.

◆ In the October issue of *Bioelectromagnetics (20*, pp.440-445), James Hatfield, Dr. Sam Milham and Richard Tell published their findings on ELF magnetic fields generated by steel-belted radial tires. They first described the phenomenon in *Microwave News* (M/A98).

◆ Could using a jammer land you in the slammer? In countries such as Japan and Israel, devices that block mobile phone signals are reported to be quite popular. In the U.S., however, the FCC issued a statement on October 12 noting that federal law prohibits their "manufacture, importation, marketing [and] operation."

◆ Dr. Gary Zeman of Lawrence Berkeley National Lab and, previously, of the U.S. Navy and Bell Labs, is now writing a regular column on non-ionizing radiation for the *Health Physics Society's Newsletter*. He closed his December column with: "If there are any risks such as cancer associated with living near power lines, then it is clear that those risks are small."

◆ Trendsetters take note: The disposable mobile phone will be here soon. The November 8 *New York Times* reported that Randice-Lisa Altschul, who has also invented an "interactive cereal," has patented a way to make phones with no plastic housing, lowering their cost to as little as $14 each.

VIEWS ON THE NEWS

Wireless Phones and Public Health: Industry Is in the Driver's Seat

Last summer Dr. Om Gandhi reported that many mobile phones violate exposure limits by causing high exposures in the ear. Industry representatives soon proposed a solution: Raise the limits (see p.1).

Surprised? You shouldn't be. Industry is firmly in control of decisions on wireless phones and public health, as it has been since the issue first emerged.

Standard-setting bodies do more or less as industry wants. Their members are often current, past or future employees of the very companies they are supposed to regulate. Meanwhile, government agencies have no appetite for confrontation. The result is that no one speaks for ordinary citizens, who are kept in the dark.

Here's an example: How much radiation is put out by your wireless phone? If you call the manufacturer, you won't find out. The official corporate position is that you don't need to know.

By law, this is public information, which each manufacturer of a new phone is required to file with the FCC. But just because it's public information doesn't mean you can get it.

After ABC's *20/20* reported on mobile phones in October, the FCC got calls from owners who wanted to know how much radiation they are getting from their particular phones. Callers were told that although the radiation numbers are somewhere in the FCC's files, they are buried so deep that no one had the time to find them (see p.6).

This is Orwellian: "Public information" that is not available to the public. Exposure numbers that must be filed but cannot be retrieved. There's a simple way to cut through all this. As we have long maintained, manufacturers should be forced to put the numbers right on the box.

Health research is another area where the public has been left out in the cold. For years the FDA has let industry set the agenda for safety research. Occasionally the agency might issue some criticism of the industry's research effort. But the FDA has never actively supervised industry-sponsored research.

Now industry funding of WTR has come to an end, with few results to show for it. The CTIA says it will fund more research, but so far only to follow up two of the WTR findings (see p.7). Certainly these deserve some attention, but there is other work on mobile phone bioeffects that is far more important.

The FDA's response to the industry plan was to ask, "Where do we sign?" There appears to have been no negotiation for a broader scope of study, or for a funding mechanism that would not allow industry to dictate what to study. In other words, the FDA is still letting the telecom industry define the research agenda.

When pressed on this point, an FDA staffer told *Microwave News* that recently the FDA had proposed federally sponsored animal studies on RF/MW health effects (see p.5). This is good news, but it prompts two questions: Why has the FDA kept this proposal secret? And why did it take so long? Certainly the need for such research was clear by 1993, if not earlier.

In any case, the FDA proposal is still just that — a proposal — and it doesn't seem to be on the fast track. No one we called would even send us a copy.

The last few months have seen more public attention paid to the cellular phone issue than at any time since 1993. The special report on *20/20* drew responses from the industry, the FDA, the FCC and Congress, and there has been prominent coverage on British, French, German and Irish TV.

But despite all the fuss, corporate interests are still firmly in control. Industry is writing its own standards, deciding what the public needs to know and telling the government what research should be done.

It will take more than a few news stories to change all that.

A Simple Wish for 2000

A hallmark of electromagnetic health controversies is that they are never resolved. When an effect is reported, it is quickly countered with an opposing result and the contradiction is left to fester.

It's time to resolve one important microwave health effect: whether low-level microwave radiation can cause leakage through the blood-brain barrier (BBB).

This fall, the European and Australian press warned that Swedish researchers are concerned that mobile phones could cause chemicals to pass through the BBB, possibly leading to Alzheimer's and other neurological diseases. This was hardly news. The same Swedish team had announced a BBB–microwave effect more than seven years ago (see *MWN*, J/A 92). And even then it was not news.

Dr. Allan Frey first reported the BBB effect 25 years ago, and U.S. Army researchers confirmed it in 1977.

The BBB work is as controversial today as it was then. James Merritt of the U.S. Air Force tried to debunk the BBB effect at the recent Moscow conference (see p.1) — just as he had tried to refute Frey's original work a generation earlier.

The impact of microwaves on membrane permeability has important implications for cell phones. The risk is not limited to the brain: The eye-blood barrier has also been shown to be vulnerable.

This is a clearly defined problem and could be settled without a major research program. It is about time.

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Birth Defect and Miscarriage Clusters Stir Up More Fears Over VDTs

The debate over VDT radiation hazards continues despite the government's verdict that the machines are safe. The controversy, initially focusing on alleged microwave-induced cataracts, now includes allegations that VDTs might affect pregnant women. In the last 18 months, there have been at least four reported clusters of miscarriages and infants born with defects among clerical workers in the US and Canada. Each group involved women who either worked on or around VDTs during pregnancy.

The cluster at the *Toronto Star* is best known: 4 out of 7 infants born to a group of VDT operators within a year had defects. Three other clusters have received less publicity: 7 out of 13 Air Canada employees in Montreal miscarried during one year; 3 cases of birth defects and 7 miscarriages out of 15 pregnancies occurred at a defense contracting office near Atlanta over one year; 8 out of 12 pregnancies had adverse outcomes at a Sears, Roebuck office in Dallas within a 14 month period.

Chance is the only explanation offered for these cases. Dr. Nancy Binkin, an epidemiologist at the Center for Disease Control (CDC), explained that clusters will occur simply because so many women work on VDTs. She hypothesized that the one case she investigated was such an "expected-unexpected" cluster.

Several unions representing VDT workers find this reasoning difficult to accept. Commenting for the Ontario Public Service Employees Union

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DOD to Expand Project ELF and Add Fourth PAVE PAWS

The Department of Defense (DOD) announced plans to expand its Project ELF antenna system and build another PAVE PAWS radar in the southwestern US, as part of its program to strengthen and rebuild the nation's command, control and communications (C^3) system.

The Navy will spend $230 million enlarging its extremely low frequency (ELF) submarine communication system, known as Project ELF, designed to send orders to submerged submarines in case of nuclear war. The existing 28-mile test facility, located near Clam Lake, WI, will be upgraded and a new transmitter with a 56-mile antenna will be built on Michigan's upper peninsula, near K.I. Sawyer AFB. The Navy plans to have the system operational by 1985.

Michigan's two democratic senators, Don Riegle and Carl Levin, immediately denounced the move as a waste of money. Northern Michigan Congressman Bob Davis said that he preferred a blue-green laser system to Project ELF. Jenifer Speicher of Stop Project ELF, a local citizen's group, warned that the DOD decision "was just a foot in the door for a much larger system," and vowed to continue to fight the project.

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(OPSEU), Robert DeMatteo said, "I don't know how anyone can chalk up the clusters to chance, to a statistical quirk. They warrant very intense investigations, including radiation testing." A number of Canadian unions, responding to the events at the *Star,* have won the right for pregnant women to do non-VDT work. Labor agreements with Bell Canada, the Open Learning Institute in British Columbia and the Ontario New Democratic Party Caucus now include this option.

This labor concern is not supported by the majority of expert opinion in the US and Canada. At both a House subcommittee investigation on VDTs (see *MWN,* June 1981) and a National Academy of Sciences symposium on VDTs and vision (see *MWN,* September 1981) the consensus was that radiation risks are negligible. Reports from Scandinavia, however, have linked high electrostatic charges from the machines to facial rashes.

Sears, Roebuck and Company

In August 1980, the consulting physician at the regional headquarters of Sears, Roebuck and Company in Dallas, TX, placed a concerned call to CDC in Atlanta, GA. Within the last 12 months, a majority of pregnancies among VDT workers resulted in miscarriages. An investigation by the center's Abortion Surveillance Branch found 7 miscarriages and a premature infant death between May 1979 and June 1980 among workers at the Sears VDT computer center. Four other pregnancies successfully came to term.

CDC could not identify a common factor to explain the 8 out of 12 adverse outcomes, according to its May 1981 report [EPI-80-113-2]. The 5,000-square-foot computer center employed 75 people and contained 29 VDTs. Only two of the eight women worked full-time on the terminals.

The CDC report described VDTs as "an unlikely cause," in part because the risk of miscarriage "was not related either to proximity to the VDTs within the room or to the amount of time spent working with the machines." It continued, "Consistency with known scientific facts is also important in establishing causality. No previous clusters of spontaneous abortion due to VDT exposure have been reported."

The estimated probability that 8 out of 12 pregnancies would be unsuccessful by chance is 6 in 10,000. The expected rate of adverse pregnancies is 16 out of 100 in the US.

CDC calculated the probability of the cluster over a three-year period encompassing 20 rather than 12 pregnancies. By beginning the time interval from August 1977 instead of from May 1979, the expected chances for the cluster rose to 6 in 1,000. Binkin, who was CDC's chief investigator in Dallas, told *Microwave News* that the longer interval was recommended by NIOSH epidemiologists to help identify trends within the population, including its normal rate of problem pregnancies. Since the report was completed, the figures have been recalculated to include a fourth year.

Binkin hypothesized the miscarriages were a chance cluster. In her report she explains: "With 7 million VDT workers in the United States, many of whom are women of reproductive age, we would expect to see—on the basis of chance alone—several clusters similar to the one reported at Sears."

CDC sent another set of questionnaires on pregnancies to Dallas this summer. No problems have been reported since the initial investigation.

Defense Logistics Agency

There were 7 miscarriages and 3 cases of severe birth defects out of 15 pregnancies between October 1979 and October 1980 at a Defense Logistics Agency (DLA) regional contracting office in Marietta near Atlanta, GA. Two other pregnancies conceived in this period failed to come to term—one was ectopic and one was terminated by a therapeutic abortion. An investigation by the Army Environmental Hygiene Agency in February could not find a cause for this cluster: it termed the birth defects an "unusual statistical event."

The Army consulted CDC in setting up its study. The center was also called in by DLA to review the Army report and to speak with employees. According to Larry Edmonds, the participating CDC epidemiologist, some workers were concerned that the Army's role constituted a conflict of interest. He said the center "basically agreed" with the report [Occupational Health Special Study No. 66-32-1359-81].

Investigators reviewed VDT use and then ruled it out as a possible factor. According to the DLA office's health and safety manager, the amount of time each woman spent on a VDT ranged from full-time to a few minutes a week. He said 14 healthy babies have been born since the study period. The office employs 206 women who are below the age of 45.

Air Canada

In the most recently confirmed cluster, 7 out of 13 pregnant employees at Dorval Airport miscarried between February 1979 and February 1981. The women used VDTs as part-time workers at Air Canada's check-in counter. The airline employs about 130 women at this Montreal-area airport.

The Canadian Air Line Employees' Association (CALEA), representing the Air Canada workers, surveyed the women at Dorval early this year and in February requested radiation checks. According to CALEA's Jane Armstrong, both the Department of Health and Welfare and Labor Canada felt tests were not warranted. At the union's insistence Air Canada hired the Canadian Standards Association (CSA) to check for X-rays. CSA found no detectable ionizing radiation among the 26 VDTs tested.

CALEA wants tests for non-ionizing radiation and precautions for VDT users, including alternate work for pregnant women. Armstrong stressed, "We must take a more critical attitude. The government should be much more involved in promoting radiation research, rather than just giving VDTs a clean bill of health."

Air Canada contends VDTs are safe. In a July 1980 position paper, company director of medical services, Dr. Peter Vaughan, cited surveys by the US National Institute of Occupational Safety and Health and concluded VDTs "do not appear capable of producing levels of radiation presenting an occupational hazard."

Frank Stevens, Air Canada's manager of airport services, underscored this position in a recent interview: "We are convinced as a company and as a country that there is no radiation problem."

Canada's Department of Health and Welfare has ruled there is no radiation hazard. According to Dr. Ernest Letourneau, director of the department's radiation protection bureau, surveys of over 200 VDTs performed in Canada over the last ten years support this conclusion. Summarizing these data in an article for the September 15 *Canadian Medical Association Journal,* Letourneau wrote: "VDTs emit no ionizing radiation

(X-rays). There is no evidence that at the detected levels the non-ionizing radiation emitted from VDTs can produce biological effects or pose any hazard to health. Thus, in the absence of a cause it is hard to establish a link between VDTs and cataracts or birth defects."

The absolute statements in this widely read article, as well as Letourneau's use of unpublished data, have drawn criticism from Toronto union officials. The author's assurance that terminals emit no X-rays, for example, appears to contradict a US Bureau of Radiological Health (BRH) report [FDA 81-8153, February 1981] which revealed some units, tested since 1975, emitted X-ray radiation. (See *MWN*, May 1981.)

Letourneau, when asked to comment, explained that the leaking units were old color sets requiring much higher power levels than common black and white VDTs. He said X-rays cannot escape from low power machines. A BRH spokesman said that two out of three models in question were color monitors.

A report on the Canadian surveys, now in draft form, should be published by spring 1982.

Toronto Star

Four cases of birth defects at the *Toronto Star* generated the most fear among VDT users. Four out of 7 pregnant VDT operators in the classified advertising department gave birth to infants with defects between May 1979 and May 1980, but two of the defects, a club foot and a cleft palet, might be explained by family medical history or the condition of the pregnancy. The causes of an underdeveloped eye in a third infant and multiple heart abnormalities in a fourth are unknown. Birth defects occur in approximately three percent of live births in Ontario.

The Ontario Ministry of Labor checked all 296 terminals at the *Star* at the request of the Southern Ontario Newspaper Guild. The classified advertising department accounted for 100 of the machines. According to the ministry's report, no power densities greater than 0.05 mW/cm^2 were detected for 10 MHz to 26 GHz radiation.

The *Star* investigation is continuing. Union and newspaper officials are now attempting to get the four women to fill out a questionnaire prepared by doctors from the University of Toronto. Only two of the women filled out a previous questionnaire made up by the *Star's* physician.

Union spokesman John Bryant confirmed that radiation is still a concern: "There is no proof that VDTs are the culprit, but we are not satisfied by the investigation of the Ontario government nor by their conclusion that VDTs are safe." According to Bryant, VDTs will be an issue in next year's labor negotiations with the *Star.* Among other measures, the union wants to guarantee the option of non-VDT work for pregnant women. *Star* policy now allows for a job change, but the union wants to formalize this rule.

At the time the *Star* story broke, rumors spread about birth defects among VDT operators at the Gander, Newfoundland, telephone company. Since Terra Novel Tel (TNT) installed VDTs in 1976, 1 infant was stillborn and 2 infants had defects out of 31 pregnancies. After the birth of the third baby, the company discovered the other birth problems and had the VDTs checked for X-ray radiation. Canadian National Telecommunications in Toronto, TNT's parent company, checked 98 machines and found no detectable ionizing radiation.

* * * * *

It is impossible to know how many clusters exist. CDC is the clearinghouse for queries on abnormal pregnancies and birth defects, and receives one or two reports of clusters each month. It cannot evaluate how many of them are significant, however. Edmonds knew of only two other possible clusters involving clerical workers, one in Great Neck, NY, and another in Washington, DC.

American Express Company contacted CDC this year when four women at its Greak Neck building miscarried between June 23 and 29. Altogether, six women miscarried between April and July. A spokeswoman for the company said none of the people involved used or worked near the 15 VDTs in the building. American Express declined to release independent reports on investigations performed by the Fireman's Fund of Connecticut and the Occupational Health Services of Union, NJ, but confirmed no causal links were identified.

In Washington, DC, a CDC survey found 7 out of 20 women in one building miscarried between spring 1979 and spring 1980. The women worked in several different offices. Because of a poor response to the center's questionnaire, Edmonds reported the survey could not confirm or rule out a problem.

The Mount Sinai School of Medicine's epidemiological study of VDT operators could be a key to evaluating "expected-unexpected" clusters. David Eisen of the Newspaper Guild believes the study's comparison of user and non-user populations "could provide the basis for figuring out if anything is happening because of VDTs." Mount Sinai's questionnaires were sent out to seven participating guild locals in late October. Project director Dr. Arthur Frank expects preliminary results by the beginning of next year.

ELF and PAVE PAWS

(continued from p. 1)

Last spring, there were reports that Chief of Naval Operations, Admiral Thomas Hayward, had recommended that the project be scrapped. Within a month, however, Secretary of Defense Caspar Weinberger decided to reactivate the then-mothballed Clam Lake facility. (See *MWN*, April and May, 1981.)

The current design for the ELF antenna is much smaller than previous proposals, Project Sanguine and Project Seafarer, which had 6,400 and 4,000 miles of antenna, respectively. In fact, the antenna is now too small to allow full communication between ship and shore. With this new system, a typical message only tells the submarine to surface in order to receive more detailed instructions.

The Air Force has decided to build a fourth PAVE PAWS radar at Goodfellow AFB, TX, in the southwestern US. The installation is designed to detect and track submarine-launched missiles from the South Pacific. An Air Force spokesman said that the total cost of the Goodfellow radar will be $100 million, compared to $90 million for the previously announced southeastern PAVE PAWS at Robins AFB, GA. Two PAVE PAWS radars are now operating at Otis AFB, MA, and Beale AFB, CA.

Other elements of the Reagan plan to upgrade the C^3 system are to develop and install very low frequency and low frequency receivers on strategic bombers and to develop a new high frequency satellite system to improve battlefield communications.

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In other developments, the Congressional Budget Office has issued a report, *Strategic Command, Control and Communications: Alternative Approaches for Modernization,* outlining various options for the Congress to consider....Eli Brookner of Raytheon has published "A Review of Array Radars," in the October issue of *Microwave Journal.* The article covers COBRA DANE, PAVE PAWS, PATRIOT and many other radar systems....Submarine laser communication will be the subject of a classified session at the IEEE's EASCON '81 "Government-Industry Interchange" at the Washington Hilton on November 17.

RF Sealer Cancer Cluster

The National Institute for Occupational Safety and Health (NIOSH) has failed to identify anything "unusual" about an alleged cancer cluster among women working with RF sealers. The agency could not link six cases of illness at the Beaverite Products plant in Beaver Falls, NY, with any physical or chemical agent. In the absence of any scientific connection between RF radiation and cancer, NIOSH decided to terminate the investigation.

The United Paperworkers International Union, which represents the Beaverite employees (Local 1518), notified NIOSH of the possible cluster in January 1980. At that time, they reported nine cases of cancer among 20 female heat sealer operators. Four of the women had died. Of the nine cases, the union said there were three women with stomach cancer, two with breast cancer, two with reproductive organ cancer, one with lung cancer, and one with pancreatic cancer.

NIOSH investigators, however, were only able to identify six of the women. According to their report, they confirmed three cases of breast cancer, one case of ovarian cancer, one case of lymphoma, and one case of chronic obstructive pulmonary disease.

In a letter to the union dated September 23, 1981, Terry Leet, an epidemiologist with NIOSH, wrote: "Regarding the Beaverite investigation, the distribution of three cases of breast cancer is not unusual, nor is the age of onset (45, 63 and 68)."

In February 1980, NIOSH took radiation measurements at the plant. According to the survey report (dated May 30, 1980), six of the eight sealers at the plant exceeded the present OSHA exposure standard of 10 mW/cm^2, which corresponds to electric and magnetic field intensities of 200 V/m and 0.5 A/m respectively. NIOSH found levels as high as 896 V/m and 1.41 A/m. (These ratings are corrected for the machines' duty cycle, taking into account that the machines are only on and emitting radiation part of the time.) There are no emission standards for RF sealers.

Seven of the RF sealers were in a room enclosed by grounded wire mesh screening. NIOSH took 14 electric field measurements in that room: the average reading was 405.5 V/m.Only one of the seven machines generated partial body exposures which were below the standard, with a measured level of 152.8 V/m. The eighth machine, which was outside the mesh enclosure, had a maximum exposure level of 174.8 V/m.

The wire mesh is designed to prevent RF radiation emissions from interfering with sensitive electronic equipment. The Federal Communications Commission is responsible for preventing these interference problems.

In the course of taking a reading at one of the machines, members of the NIOSH team "experienced heating sensation in the forearms and legs." This phenomenon, they wrote in their report, "is an indication that exposed personnel are absorbing significant amounts of RF energy."

In his letter to Robert Frase, the union's director of occupational health and safety, NIOSH's Leet wrote: "There is no convincing evidence in the scientific literature to indicate that RF radiation causes cancer in humans and animals. Thus, NIOSH plans to terminate its investigations of the alleged cancer cluster...." Leet did note that NIOSH may collect cancer mortality data in its planned RF sealer epidemiology.

Speaking from the union's headquarters in Nashville, TN, Frase said he had to defer to NIOSH's judgment on the cluster since the agency's staff has more expertise than he does, but he went on to say that he would like to see more work done in the area.

In a telephone interview, Leet said that the study population for the NIOSH epidemiology had not been selected yet. He attributed the delays to finding a cohort of RF sealer operators with the desired characteristics. "We feel this is a major study, and we want to make sure that we have eliminated any flaws in study design before we begin," he explained.

RF Sealer Meeting and Booklet

Representatives from the Bureau of Radiological Health (BRH), the National Institute for Occupational Safety and Health (NIOSH) and the Occupational Safety and Health Administration (OSHA) met at BRH in Rockville, MD, on October 7 in another attempt to deal with RF sealers.

According to BRH's William Herman, there was general agreement among the 15-odd participants that there is a significant problem associated with the sealers, that a solution to the problem exists and is technically feasible and that a collaborative approach is necessary. A number of control strategies were also on the agenda, including voluntary performance standards for sealer manufacturers.

Now that the Interagency Regulatory Liaison Group (IRLG) has been dissolved (see opposite page), and with it the RF/MW committee, which was working on RF sealer problems, this informal group may continue some of the IRLG's work. Although another meeting is expected, no date has been set.

Meanwhile, NIOSH and BRH are completing their booklet on control and monitoring techniques for RF sealers. According to NIOSH's Dave West, the booklet is a top priority at the agency's Cincinnati office; it should be in draft form by the end of the year, and be publicly available a couple of months later.

Occupational Health Course

The Rocky Mountain Center for Occupational and Environmental Health (RMCOEH) at the University of Utah is sponsoring a two-day course on "Current Issues and Trends in Controlling Occupational Exposures to RF/Microwave Radiation" next February 17-18. OSHA's Robert Curtis will be the instructor. For more information contact: Ms. K. Blosch, RMCOEH, Building 512, University of Utah, Salt Lake City, UT 84112, (801) 581-5710.

BRIEFS

The Fifth Estate, a Canadian Broadcasting Company public affairs program, aired a segment on microwave and radiofrequency radiation on October 20. The bulk of the show was devoted to the hazards associated with RF sealers. Transcripts of the program are available from: Robin Taylor, Executive Producer, Fifth Estate, PO Box 500, Station A, Toronto, Canada....The Center for Disease Control (CDC) has officially put off the NIOSH move. For a critical look at the troubled agency, see Marjorie Sun's "Reagan Reforms Create Upheaval at NIOSH," in the October 9 *Science*....Anthony Goldin has been named director of OSHA's offices of policy, legislation and regulatory analysis. He succeeds Mark Cowan, who was previously promoted to deputy assistant secretary of labor for occupational safety and health. Goldin comes to OSHA from the CIA, where Cowan also served for five years....According to the *Washington Post* (October 28), the Reagan budget cuts are having an impact on OSHA programs. The average number of monthly workplace inspections between February and August of this year has declined 17% compared to the average between January and October 1980. Follow-up inspections are down 68% and citations for violations are down 27%.

GOVERNMENT

IRLG Comes to a Quiet End

The Interagency Regulatory Liaison Group (IRLG), including its radiofrequency and microwave (RF/MW) committee, has come to a quiet end. The IRLG's charter ran out at the end of September and was not renewed. Several members of the RF/MW committee told *Microwave News* that they had heard nothing official about the IRLG's demise and had first learned about it from the *Washington Post.*

The IRLG was set up in September 1977 by the heads of the Environmental Protection Agency (EPA), the Food and Drug Administration (FDA), the Occupational Safety and Health Administration (OSHA) and the Consumer Products Safety Commission (CPSC) to coordinate regulatory policy on health issues. Members of the RF/MW committee, which was formed in October 1978, sought to work together on bioeffects research and control strategies.

One of the committee's first objectives was to contract the National Academy of Sciences (NAS) for a critical appraisal of the health effects of RF/MW radiation. Due to a string of funding and bureaucratic snafus, an agreement between the IRLG and the NAS was never reached.

In May 1979, the committee drafted a strategy to protect workers from RF sealer radiation: "An IRLG Plan to Reduce Excessive Exposure of Operators to Radiation from RF Sealers." According to the IRLG's most recent regulatory report, issued in December 1980, the member agencies were scheduled to make their final recommendations on RF sealers last summer.

Some of the work of the IRLG's 21 committees will continue under a new body headed by President Reagan's science advisor, George Keyworth. At present, there are no official plans to salvage the RF/MW committee, though some EPA and National Institute for Occupational Safety and Health (NIOSH) and Bureau of Radiological Health (BRH—within the FDA) officials met on October 7 to address RF sealers. (See opposite page)

TEPRSSC Meeting Planned

The Bureau of Radiological Health's Technical Electronic Product Radiation Safety Standards Committee (TEPRSSC) has scheduled a meeting for December 9-10 in Rockville, MD. The main topic on the agenda is the proposed performance standard for sunlamps and ultraviolet radiation lamps. TEPRSSC's Executive Secretary Dr. Zory Glaser said that he expected that there would also be updates on RF sealers and on the BRH microwave oven amendment (see *MWN,* May 1981).

BRH received a large number of nominations for membership to TERPSSC. The final selection process is under way and Glaser hopes to announce the names of the new members, whose terms will begin on January 1, at the meeting. For more information contact Glaser at (301) 443-3429.

BRIEFS

The National Bureau of Standards (NBS) has developed a new, portable meter to measure electromagnetic radiation in the frequency range covering the AM, FM and TV broadcast bands. The isotropic electric field monitor, EFM-5, covers the range between 200 kHz and 1 GHz for fields as low as 1 V/m and as high as 1,000 V/m. A full description of the meter is contained in NBS Technical Note 1033: *Design and Calibration of the NBS Isotropic Electric-Field Monitor [EFM-5], 0.2 to 1000 MHz,* available from the Government Printing office for $4.50. Stock no. 003-003-02311-6....The printed transcript of last May's congressional hearings on VDTs and RF sealers, *Potential Health Effects of Video Display Terminals and Radio Frequency Heaters and Sealers,* is now available from the House Science and Technology Committee. For a copy write to the committee at the House of Representatives, Washington, DC 20515, include a self-addressed mailing label. To order by phone, call (202) 225-5629....

CONFERENCES

Thermoregulation Symposium

The symposium on *Microwave and Thermoregulation* brought together 80 experts from the bioelectromagnetics community and the John Pierce Foundation at Yale medical school on October 26-27. The foundation's Dr. Eleanor Adair, the symposium organizer, described the meeting as "extremely successful."

Adair explained that one of her objectives in setting up the conference was to expose the Pierce Foundation scientists to the current research problems of the microwave community. And conversely, the microwave experts became aware of the technical and scientific expertise that exists at the Pierce labs. "We started a dialogue between the two groups," she said.

In addition to the seven sessions of papers, there was a tribute to the late George Sacher, a former research biologist at Argonne National Lab, who died earlier this year. Professor Charles Susskind of the University of California, Berkeley, delivered the keynote address, "Beyond Thermoregulation," at the symposium banquet.

In an interview at the meeting, Dr. Gregory Lotz of the Naval Aerospace Medical Research Lab in Pensacola, FL, said that he had replicated his experiments that showed dramatic heating of male rhesus monkeys in 225 MHz RF fields at a power density of 5 mW/cm^2, an SAR of 1.5 W/Kg. These results caused quite a bit of excitement when they were first presented at last August's Bioelectromagnetics Society meeting (see *MWN,* September 1981).

Since the summer, Lotz has done some additional work on dosimetry, which indicates that his original SAR estimates may have been too low. A set of measurements using a simple saline block yielded an SAR of 2.7 W/Kg, which is much closer to the resting metabolic rate of the rhesus monkey. "We must still do more work to explain the August results," he said, "and we must get a better handle on just how much energy is getting in as well as how it is distributed and dissipated." Lotz will continue to work at 225 MHz and expects to have more results next year.

Lotz went on to stress that his work may have important implications for hyperthermia as a tool in cancer therapy. If his results can be applied to humans, whole body heating may be more easily achieved by using resonant frequencies.

In his paper at the meeting, Dr. Jerome Krupp of the Air Force School of Aerospace Medicine at Brooks AFB, TX, described his research with a similar system; his experimental results are in general agreement with Lotz's. Krupp used a frequency of 219 MHz and found that the monkeys became hyperthermic at power levels between 7.5 and 12 mW/cm^2—an SAR of 5 W/Kg. While Krupp agreed that the resonance phenomenon was real, he did not detect any hot spots in the living animals. He found only uniform temperature rises. Krupp used anesthetized animals, while Lotz's monkeys were awake. The two sets of animals were also in different positions in the field.

Academic Press plans to publish the papers presented at the symposium by the end of the summer of 1982.

The Food and Drug Administration has compiled the significant preambles for all *Federal Register* documents relating to radiological health and medical devices regulations from April 1978 through March 1980. The volumes are available from the Government Printing Office: Radiological Health, stock no. 017-015-00196-2, $4.50; Medical Devices, stock no. 017-015-00195-4, $8.00....In contract news: the Army Communications-Electronics Command at Fort Monmouth, NJ, has awarded $300,000 to Signatron in Lexington, MA, to "determine the requirements and characteristics of a generic line of sight radio family for the 1990's time frame," and is looking for a contractor to "establish a technical base for microwave testing techniques." The Army Research Office in Research Triangle Park, NC, has signed a $110,186 contract with the University of Kansas, Lawrence, for a study of "microwave dielectric constant dependence on soil tension."

LITIGATION

Radar Case Settlement

Leo Foley, who served aboard an EC-121 constellation and alleged radiation-induced cataracts, has settled his complaint out of court for $25,000, according to Joseph Gregorich, an attorney representing the Lockheed Corp. Gregorich reports that the settlement was reached following a conference of the interested parties in mid-August.

In papers filed in California State Court in Sacramento on April 9, 1979, Foley sought damages from General Electric, Hazeltine, Hughes, Lockheed, Philco-Ford, Raytheon and Telrad-Lionel. He alleged that while serving aboard EC-121 aircraft between May 1957 and December 1975, he had been exposed to radiation from search radars AN/APS 20 and AN/APS 95, height-finder radar AN/APS 45 and navigation radar AN/APS 42.

Foley was represented by San Francisco attorney Seymour Ellison. Ellison could not be reached for comment. Gregorich is with the firm of Kirtland and Packard in Los Angeles.

MW Oven Case May Go to Trial

A suit brought by two legal secretaries against the Amana Refrigeration Co., alleging microwave-induced cataracts, may go to trial next January. Mark Decof of Decof and Grim in Providence, RI, said that he is seeking $3 million from Amana for his clients: half a million for Dolores Delsesto and Lynn (and Michael) Spinella for their cataracts and another million dollars each for punitive damages.

The secretaries—one has a single cataract and the other two—worked at a law firm where there was an Amana oven in the lunchroom. Each woman had an assigned seat in the room, and they were the closest to the oven. The plaintiffs are alleging that the oven caused their cataracts. Decof explained that they are seeking punitive damages because Amana's brochures proclaimed in bold lettering the oven "Does Not Emit X-Ray Radiation," which, they contend, misled them into thinking that there were no radiation risks.

The oven was examined by a mechanical engineer in Providence who found that it did not leak above the federal standard. Decof will argue, however, that the standard does not afford sufficient protection.

Steve Gustafson, legal counsel for Amana in Amana, IA, was out of the country and could not be reached for comment. The original complaint was filed on February 16, 1979, in US District Court in Rhode Island [CV 79-0082].

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MEDICAL APPLICATIONS

NCI Begins Major Hyperthermia Study

The National Cancer Institute (NCI) has begun a five-year, multimillion dollar study of hyperthermia equipment. NCI will spend a little less than a million dollars a year at five teaching hospitals to assess the performance of RF, microwave and ultrasound hyperthermia systems for heating tumors in the major anatomical sites.

The five participating institutions are: the medical schools at Stanford University, the University of Utah and the University of Arizona, the M.D. Anderson Hospital and Tumor Institute at the University of Texas in Houston and the Massachusetts Institute of Technology in cooperation with New England Deaconess Hospital. Among the types of tumors to be treated are those of the brain, head, neck, lung, pelvis and lymph nodes.

Each hospital will test at least two types of hyperthermia equipment. These include the RF Magnetrode unit and the BSD Medical Corp.'s microwave device. The decision on which hospital will test which systems will be made at a workshop to be held at NCI in December.

According to Dr. Francis Mahoney, program director for radiation in NCI's radiotherapy development branch, this work is designed to get better coordination among those working on hyperthermia and to get reliable baseline data on the systems' efficacy.

The Bureau of Radiological Health (BRH) will be working with NCI on this study. BRH will assist with dosimetric and thermometric analyses of the equipment.

BRIEFS

The minutes of the April 2–3 meeting of the Radiology Section of the Obstetrics-Gynecology and Radiology Devices Panel of the Food and Drug Administration (FDA) have been completed and are available from the FDA. At the meeting, the section voted unanimously to deny pre-market approval to the Magnetrode hyperthermia system (see *MWN*, May 1981)....The International Microwave Power Institute (IMPI) voted to set up a new Biomedical Section at its annual meeting in Toronto last June. Drs. Howard Clark of the National Bureau of Standards (NBS) and Augustine Cheung of the University of Maryland are setting up a steering committee to organize the new section. Interested parties should get in touch with Clark: NBS, Bldg. 220, Room B-358, Washington, DC 20234....There will be a session on the Applications of NMR in Biology and Medicine at the AAAS meeting in Washington next January 5. For more information contact the AAAS, 1515 Massachusetts Avenue, NW, Washington, DC 20005 ....In their article, "Recent Developments in Nuclear Magnetic Resonance Spectroscopy," in the October 16 *Science*, Syracuse University's Drs. George Levy and David Craik offered an upbeat assessment of the future of NMR in biology: "The recent developments in NMR studies of cells, organs and whole organisms indicate a bright future for NMR in biomedical disciplines. It will be used by the pharmacologist as a structural probe for new drugs, will aid the pathologist in analyses, and, we believe, will eventually become a routine screening or diagnostic device." With respect to NMR imaging, they wrote: "Routine clinical whole-body scanning of human patients is some years away. However today, in controlled laboratory experiments, it is possible to obtain NMR images of cross sections of human subjects at sufficient resolution (a few millimeters) to yield valuable physiological information."...A similarly optimistic view is expressed by Michael Waldholz in the October 23 *Wall Street Journal's* "Technology" column. Dr. Ronald Ross of Gates Mill, OH, one of the first users of an NMR imager, told Waldholz that he feels NMR will change the way medicine is practiced. A spokesman for Picker International Ltd. is quoted as saying that the company plans to deliver as many as 12 NMR units by the end of the year. Picker is a subsidiary of General Electric Co.

UPDATE

Biological Effects....The radiation physics research group of the School of Aerospace Medicine at Brooks AFB, TX, is looking for a contractor to build life-sized human phantoms that have bone structure and that can be filled with tissue-like liquids. The phantoms will be used to measure internal electric fields and SARs, according to Brooks' John Mitchell.... Meanwhile, dosimetry research is continuing at the University of Utah under AF contract. Mitchell said that a decision has yet to be reached on whether to publish a fourth dosimetry handbook....In a three article series in the second issue of Volume 2 of *Bioelectromagnetics*, a team from the University of Utah report that they were unable to detect frequency-specific athermal effects on protein synthesis at millimeter wavelengths 38–48 GHz and 65–75 GHz....Michael Morgan describes a model calculation of microwave absorption by the cranial structure in the October *IEEE Transactions on Biomedical Engineering*.

Standards....The American National Standards Institute (ANSI) has officially called for public comment on its new safety standard for human exposures to RF/MW radiation. For a copy of the final proposal send $5.00 to the Institute of Electrical and Electronic Engineers (IEEE), Attn: M. Lynch, 345 East 47 Street, New York, NY 10017. Ask for standard No. BSR C95.1 (revision of ANSI C95.1-1974). Send comments to Vincent Condello at the IEEE, with a copy to the Board of Standards Review, ANSI, 1430 Broadway, New York, NY 10018. They are due by December 1.

VDTs....Two bills on VDTs have been prepared for the Ontario provincial legislature. On October 15, Al Kolyn introduced a measure covering VDT ergonomics [Bill 149]. A second bill, addressing radiation as well as ergonomics, will be introduced soon....A demand by clerical staff for extra pay for working on VDTs prompted 1,500 workers at Britain's Lucas Aerospace to walk off the job last month. According to the October 20 *London Times*, the company maintains introducing terminals does not justify more pay. The walkout was called in support of 80 employees threatened with dismissal over the wage demand....Over 290 delegates met in Toronto, October 16–18, for a VDT hazard symposium. According to Robert DeMatteo of the Ontario Public Service Employees Union (OPSEU), one of the meeting's organizers, there was a growing consensus among the delegates that unions should push for universal VDT testing, for legislation regulating radiation and ergonomic factors related to VDTs, for a central labor body to coordinate research and collect information and for the inclusion of VDTs in the collective bargaining process. ...OPSEU has prepared a 62 page booklet, *The Hazards of VDTs*, including radiation and ergonomic issues. A copy can be obtained from DeMatteo, OPSEU, 8th Floor, 1901 Yonge Street, Toronto, Ontario, M4S 2Z5....A survey at the *New York Times* found VDT operators experienced more eye discomfort than non-operators. The September 25 *Guild Reporter* covered the results of the survey conducted last year by three occupational health specialists from the University of Wisconsin. A total of 123 workers participated.

Satellite Communications....The Federal Communications Commission (FCC) has proposed reducing the space between satellites operating in the 4/6 GHz and 12/14 GHz bands to 2 degrees from 4 degrees. The action was prompted by the rapidly increasing demand for orbital slots. According to the FCC's Ron Lepkowski, the commission is now soliciting comments and hopes to make its final decision by the fall of next year.... A special report on "Assessing Antennas for Small Satcom Terminals" appeared in the October issue of *Microwave Systems News*....RCA has taken a new approach for allocating transponders. The company will auction leases for seven transponders on its new Cable Net 2 satellite at Sotheby Parke Bernet in New York City on November 9.

Technology....The Department of Energy's (DOE) Morgantown Energy Technology Center has signed a $56,774 contract with the BDM Corp. of McLean, VA, to develop a prototype microwave diagnostic system to detect and characterize bubbles in a fluidized bed combustor....James Jolley and Charles Dotson give an overview of synthetic aperture radar in the September *Defense Electronics*....RF radiation has been used to heat plasmas in the search for a self-sustaining fusion reactor, according to a report in *Science News*, October 24....DOE has awarded Auburn University in Auburn, AL, $46,300 for theoretical studies of the heating of toroidal plasmas with RF radiation at the lower hybrid frequencies.... Three staffers from the Federal Aviation Administration's Technical Center describe the feasibility of using radar to detect dangerous wind shear at airports in the September issue of *Microwave Systems News*....The September-October issue of *Radio Science* includes a special collection of papers on the effects of the lower atmosphere on radio propagation at frequencies above 1 GHz....Caltech's George Born reviews the largely successful history of Seasat, the first satellite to use microwave remote sensing in the October 22 *Nature*....A report on the use of active and passive microwave remote sensing of Hurricane Allen in August 1980 appears in the October 16 *Science*.

EMP....The Reagan administration's plans to upgrade the command, control and communications system includes the hardening of all Boeing B-52s, according to the October 26 *Aviation Week & Space Technology*. An additional $1,240 million has been requested for FY 83-86 to protect the bombers from electromagnetic pulses (EMP)....William Broad reports in the October 16 *Science* that the Department of Defense has indefinitely postponed the $100 million Satellite X-Ray Test Facility that would simulate the EMP effects of a nuclear blast in space on military satellites....In a letter to the *IEEE Spectrum* (October), Major Philip Corn and Dr. John Corbin of Wright-Patterson AFB, OH, write "lightning presents a localized threat of equal or significantly greater magnitude than [nuclear] EMP over a wide frequency range, from the kilohertz well into the MHz range or beyond." They predict that at least one multi-agency, integrated program will protect aircraft from lightning, nuclear EMP, and electromagnetic interference "in the immediate future."...The IRT Corporation has published a pamphlet on *EMP Susceptibility Analysis*. For a copy write to IRT, 7650 Convoy Court, PO Box 80817, San Diego, CA 92138....Kirtland AFB, NM is looking for a contractor to evaluate the performance of satellite communications systems "while stressed to nuclear effects," *Commerce Business Daily*, October 13.

BOOK REVIEWS

Martin D. Ecker and Norton J. Bramesco, *Radiation: All You Need to Stop Worrying—Or to Start.* New York, NY: Vintage Books, 1981, 226 pp., $4.95 (paper).

Most of the advice these authors offer is about ionizing radiation. Two chapters are devoted to non-ionizing radiation: one on biological effects and standards and another on reducing the risks of over-exposure. The few pages on risk reduction are about microwave ovens.

The overview on health, which lumps together microwave, UV and IR radiation as well as visible light, is spotty; no mention is made of the current efforts to revise the exposure standards. To be useful, the bibliography should have been given more attention. The glossary essentially ignores everything except ionizing radiation jargon.

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Barry M. Casper and Paul David Wellstone, *Powerline, The First Battle of America's Energy War.* Amherst, MA: University of Massachusetts Press, 1981, 314 pp., $7.95 (paper), $18.50 (hardcover).

Powerline chronicles the planning and construction of a 430 mile, 800 KV transmission line from the perspective of those living in its path. The authors contend that the prolonged opposition to the line, which runs from a North Dakota coal field to Minneapolis, illustrates a fundamental conflict between the attitudes of rural Americans and US energy policy. If highly centralized development of coal is pursued, they predict other power lines will meet similar resistance.

This history of the construction project, completed in 1979, contains many interviews with protesting farmers, with less attention given to the pro-line viewpoint. Land use was the central issue in this battle, although the opposition did raise the possible health hazards of high power, direct-current lines later on.

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Wilson Clark and Jake Page, *Energy, Vulnerability and War.* New York, NY: W.W. Norton, 1981, 251 pp., $5.95 (paper), $12.95 (hardcover).

What would happen if the Soviet Union exploded two nuclear bombs 65 miles above Tennessee and Nevada, and then, having used electromagnetic pulses (EMP) to black out all communications, destroyed the nation's oil refineries? Beginning with this premise, Clark and Page argue against highly centralized, and therefore vulnerable, energy systems.

The book, a popular version of a study commissioned by the Defense Civil Preparedness Agency, recommends ways for the country to avoid becoming an "economic basket case." Small scale energy systems, such as solar, wind and geothermal power, are advocated to diffuse an energy war. The authors do not return to hardening strategies or other ways to protect against EMP.

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Sidney Lerman, *Radiant Energy and the Eye,* Vol. 1 of the Functional Ophthalmology Series. New York, NY: Macmillan Publishing Co., 1980, 321 pp., $49.95.

Lerman concisely summarizes current understanding of radiation effects on the eye. Reviews of the most pertinent literature on low frequency to ionizing radiation effects are preceded by a clear presentation of the eye's morphology, composition and function. Each chapter contains illustrations, footnotes and general references.

With respect to thermal and potential non-thermal cataracts induced by microwave and radiofrequency radiation, the author finds that, at power levels of 100 mW/cm^2 and above, thermal damage to the lens is well-documented; at lower levels, however, the potential effects of long-term exposure are still poorly understood and not adequately studied. Citing the work of Stephen Cleary, Lerman states that non-thermal effects following multiple exposures cannot be ruled out. This radiation "may act synergistically with other endogenous or exogenous factors, leading to functional alterations of specific molecules...."

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Leon Kaufman, Lawrence Crooks and Alexander Margulis, eds., *Nuclear Magnetic Resonance Imaging in Medicine.* New York, NY: Igaku-Shoin, 1981, 242 pp., $29.50.

Only a few years ago, NMR imaging was the province of the researcher. Now, as the time grows near for NMR as a routine diagnostic technique, this book provides a useful general introduction to the field.

This collection of original articles was edited and largely written by staff members of the University of California's Radiologic Imaging Laboratory in San Francisco. The heart of the book contains five articles describing the application of NMR for imaging in animals and humans and in measuring blood flow, using proton density maps as well as those of heavier nuclei. An introduction to the physics and hardware of NMR and a discussion of the potential health effects of extended exposures to high magnetic and RF fields are also included.

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Om P. Gandhi, *Microwave Engineering and Applications.* Elmsford, NY: Pergamon Press, 1981, 544 pp., $24.50 (paper), $60.00 (hardcover).

Professor Gandhi has written this text for a yearlong course on microwave engineering. Fifteen chapters cover everything from transmission lines to integrated circuits. Antennas, waveguides, passive and ferrite components, vacuum tubes and semiconductor diodes are all given detailed attention.

Gandhi provides the reader with references, sample exercises, problems and even computer programs. The well-illustrated, typescript book is for mathematically adept students and is intended to teach them how to design microwave components, devices and systems.

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Infrared and Millimeter Waves. New York, NY: Academic Press. Volume 3: "Submillimeter Techniques," Kenneth Button, ed., 1980, 428 pp., $50.00; and Volume 4: "Millimeter Systems," Kenneth Button and James Wiltse, eds., 1981, 364 pp., $46.00.

These annual collections provide comprehensive, technical reviews of the fast developing fields of mm and sub-mm waves by some of the leading researchers. Much of Volume 3 is on detection techniques: an overview chapter is followed by three chapters on specific detectors—Schottky barrier diodes and pyroelectric and photon drag detectors. The rest of the book is devoted to laser systems and spectroscopic techniques.

Various chapters in Volume 4 describe sources of mm wave radiation and their application in radar, missile guidance and imaging. Wiltse's brief introduction to the subject is especially useful to the uninitiated reader; he reviews both the technology and how it is used, listing a large number of references.

MICRO WAVE NEWS

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The Microwave News *litigation survey for 1982 will appear in our December issue.*

Microwave News *invites letters from its readers. We ask writers to be brief, and we reserve the right to edit contributions for length.*

In the USSR

Research Program Gains, New Standards Set

Four American scientists who visited the Soviet Union this summer say its research program on radiofrequency and microwave (RF/MW) radiation is blossoming. All four report being very impressed with the breadth and depth of the Soviet effort.

"Soviet research in this field is considerably greater, perhaps as much as ten times greater, than ours," said Professor Howard Wachtel of the University of Colorado in Boulder. The Russians are placing special emphasis on non-ionizing radiation compared to other scientific areas, he added. Professor Frank Barnes, Wachtel's colleague and collaborator, agreed with this assessment and explained that a top-level committee of the Soviet Academy of Sciences had ordered greater emphasis on RF/MW radiation research four years ago. "There was too much confusion in the field and they decided to do something about it," Barnes said.

Barnes and Wachtel estimated that there are more than a thousand scientists doing research on RF/MW radiation at about 50 different Soviet institutes. The two Colorado scientists, who are with the university's Department of Electrical Engineering (Barnes was the department chairman until recently), toured several Soviet research laboratories last July as guests of the Institute of Biophysics of the USSR Academy of Sciences.

In September, Drs. Donald McRee and Mays Swicord traveled to the Soviet Union to confer on plans for a joint experiment to be run in both countries. (Rats will be exposed to 10 mW/cm² of 2450 MHz radiation for seven hours (see *MWN*, July/August 1982).) McRee, who is with the National Institute of Environmental Health Sciences (NIEHS) and is the coordinator of the US-

(continued p. 8)

NIOSH Planning Reproductive Study of VDT Workers

Officials at the National Institute for Occupational Safety and Health (NIOSH) have disclosed that they may soon begin to study the impact of video display terminals (VDTs) on pregnant women. Dr. Michael Rosenberg, the chief of reproductive health at NIOSH laboratories in Cincinnati, OH, told *Microwave News* that the agency was in the midst of negotiations with a number of institutions to identify a suitable cohort population. If an agreement is reached, the study could begin in the spring. Present plans are to include 5,000–6,000 pregnancies in a retrospective survey.

Over the last two years, women have grown increasingly concerned about the risks associated with working at VDTs during pregnancy as clusters of miscarriages and birth defects have been discovered among VDT operators. To date, eight confirmed clusters have been reported in the United States and Canada (see *MWN*, July/August 1982 and November 1981). Many VDT

(continued p. 8)

HIGHLIGHTS

Canadian Task Force Recommends VDT Safety Rules

A federal task force in Canada has recommended that VDT operators be given the option of doing alternative work during pregnancy with no loss in pay while national safety standards for office workers are developed.

In a report released to the Minister of Labor on November 3, the Task Force on Micro-Electronics and Employment asks the government to establish office safety regulations and outlines interim rules for VDT work. Along with the right for job transfer during pregnancy, it recommends that employers limit continuous VDT work to at most five hours a day and provide hourly rest breaks. It also advises that employees beginning VDT work should get initial eye examinations followed by annual check-ups and that employers should pay for the special corrective lenses needed by some VDT workers.

Murray Hardie, the task force's executive director, explained that interim rules are needed because no firm research exists to allay worker fears. "As long as we don't know if there is a problem, we must err on the side of caution," he said. The task force report urges the government to continue "to fund medical and other research into health and safety concerns of people working with micro-electronics equipment, especially VDTs, including more research into the adequacy of currently acceptable levels of radiation and the methods of testing for radiation emission..."

According to Julyan Reid of the Canadian Ministry of State for Social Development, the report contains "the strongest statement on VDTs yet from North America." Noting that most task force recommendations end up unheeded, Reid said this issue is too important in Canada to be ignored. In fact, an advance story of the report was front page news in the *Globe and Mail*, the country's major national newspaper.

Word of the recommended guidelines drew pleased but cautious responses from union representatives. Robert DeMatteo of the Ontario Public Service Employees Union called the report "a long overdue step in the right direction." He said government regulations for VDTs "are essential" but added that effective rules must include mandatory shielding and testing for radiation emissions for all new machines. Gary Cwitco of the Communications Workers of Canada said the recommendations looked good, but could not comment further "until I see them in the context of the full report, which covers a broad range of office employment issues."

As for the recommended option of alternative work for pregnant women, Reid and the union representatives warned that it is a very short-term, though positive, step. DeMatteo explained that the transfer right "is an important but makeshift measure as long as the units emit radiation that we know so little about."

In the US, David Eisen of the Newspaper Guild also said that transfer is only a temporary solution. "The task force has made a good beginning," he said, "but the radiation issue will only be resolved when research determines whether a problem exists and, if so, what that problem is." Eisen was glad to see that the report recommends more research on other possible office risks, such as PCBs.

The 89-page report, *In the Chips: Opportunities, People, Partnerships,* reviews productivity, job security and training issues as well as health and safety. It is available from Labour Canada, Ottawa, Ontario K1A 0J2. ●

Trial Date Set in Engell Case

Robert Engell's suit against the manufacturers of radar equipment he alleges exposed him to harmful levels of microwave radiation is scheduled to begin this month. After five years of pre-trial discovery, jury selection has been set for November 9 in the US District Court for Connecticut in Hartford. Testimony is due to begin the following day.

Engell was a civilian radar repairman at the Naval Air Station at Quonset Point, RI, from 1964–1973. In his early 30's Engell developed pancreatic cancer and endocrine disorders, which he contends stem from working with TACAN and other radars. (TACAN stands for Tactical Air Navigation.) In March 1977, he filed a $4.5 million suit against ITT, Raytheon, General Dynamics, Varian Associates and Rockwell International.

Marc Moller of Kreindler & Kreindler in New York City and Matthew Shafner of O'Brien, Shafner, Bartinik, Stuart & Kelly in Groton, CT, are representing Engell.

Attorneys for both the plaintiff and the defendants refused to comment on the suit before the trial.

Two aspects of the case are especially noteworthy. First, one of Engell's co-workers died of pancreatic cancer in the early 1970's. Second, TACAN radars can also emit x-rays, a known cancer-causing agent; this could cloud the microwave-cancer issue.

Although similar cases have been filed, all have been settled out of court. Some plaintiffs have received substantial settlements, however. Ronald Karras, for example, received $200,000 from the General Electric Co. and the Western Electric Co. in a case concluded last year. (See *MWN,* July/August 1981.) After the award, neither side would offer any details on the settlement. ●

RCA's Satcom Station Blocked Again in Seattle Area

The Board of Commissioners for Kitsap County, WA, has denied RCA's application to build a satellite communications station on the company's second proposed site. The October 18 ruling is the latest of several setbacks in RCA's long struggle to place a facility in this Seattle-area county. The company is now filing an appeal.

In a unanimous decision, the three-member board cited both inappropriate land use and uncertainty over radiation health effects in rejecting a siting application from RCA Americom (RCA American Communications). The company had proposed putting its station on a tract of forest land in the Indianola-Kingston area. Earlier plans to build on the county's Bainbridge Island were put on hold after unabating local opposition delayed the project's progress. (See *MWN,* July/August and October 1982.)

According to Americom's John Williamson, the company is filing an appeal in a county superior court. It is also keeping open its options to seek approval for the Bainbridge site or to look for another potential location.

Given the board's reasons for rejecting the Indianola-Kingston proposal, county official Richard Kimball doubts that Americom will find a home for its station in Kitsap. In his view, returning to Bainbridge "would be throwing good money after bad" and finding another sufficiently isolated and technically acceptable site "may well be impossible."

The commissioners took a clear stand on the radiation issue

in their decision. In their view, "What is important from a public policy perspective is the degree to which a broad segment of the affected populace perceives that they and their children are at risk." Although RCA "may be willing to take [this risk] based on what they know and based on what they have to gain," the board members concluded that they should not. Pointing to what was learned after the fact about asbestos, atomic radiation and Love Canal, they stated that, "as long as there remain serious questions about microwave radiation the prudent thing for the county to do is err on the side of caution." The board's action followed a community group's appeal of a county hearing examiner's recommendation for permit approval.

Americom's proposed station includes two large dish antennas and a tall relay tower. The site would provide a satellite link for private communications traffic to and from Seattle. ●

Swedish Study Supports Power Line Cancer Link

Swedish researchers have found preliminary evidence to support an association between cancer and electrical wiring. In an attempt to test the results of an American study, the Swedes found that children living in homes near 200-kV power lines had a greater than expected chance of developing tumors. Similarly, children in homes with ambient magnetic fields of 3 milligauss or greater had a higher rate of cancer.

Drs. Lennart Tomenius and Lennart Hellstrom, medical officers with the County of Stockholm, and Dr. Bengt Enander of the Royal Institute of Technology in Stockholm concluded that their work "confirms" the epidemiological study of Dr. Nancy Wertheimer and Ed Leeper, who reported a connection between 60-Hz fields and cancer among children living in Denver, CO. *(American Journal of Epidemiology, 109,* 273, 1979. (Note that power lines in Sweden operate at 50-Hz compared to 60-Hz in the US.) The Swedish results were presented in a paper delivered to the *International Symposium on Occupational Health and Safety in Mining and Tunneling* held in Prague last June.

"It feels good not being out there all alone anymore," said Wertheimer in a telephone interview. She added that she had been in sporadic contact with the Swedish team, but had still only seen the short paper written for the Prague meeting. "I look forward to seeing a more detailed write-up," she said.

Although the paper has not received wide distribution, Dr. Robert Becker had read it and offered the following assessment: "It is an important contribution in light of Wertheimer's original paper and the recent report by Milham [see *MWN,* July/August 1982] in Washington state." He stressed that the exposure levels were not very high, "We are dealing with everyday exposures." Becker was an active researcher on non-ionizing radiation at the VA Medical Center in Syracuse, NY, until his retirement last year.

The Swedish team argues that although their study cannot affirm a causal link between high voltage wires or magnetic fields with the incidence of tumors in children, such a causality cannot be excluded. ●

BRH Issues Report on Controlling RF Sealer Exposures

The Bureau of Radiological Health (BRH) has published a booklet on ways of reducing radiation exposures from radiofrequency (RF) sealers. The report illustrates the types of shielding used on a variety of different sealers and details the efficacy of preventive measures.

RF sealers are used to bond together materials like plastic or rubber. The government has estimated that there are about 20,000 RF heaters and sealers now in use, operated by some 40,000 workers.

One example of shielding cited by BRH is on Solidyne Inc.'s new standard 10-kW RF sealer operating at 27 MHz. With shielding in place, power densities based on measured electric and magnetic fields were 0.01 and 0.27 mW/cm² at a distance of 10 cm from the machine. When the shielding was removed, however, field strengths were too strong for the meter at 10 cm. At a distance of 30 cm, the equivalent power densities for electric and magnetic fields were 130 mW/cm² and 14 mW/cm² respectively. (None of the power levels cited here allow for the duty cycle of the machine: that is the ratio of the time the radiating source is "on" to the total time for one cycle of production.)

A theoretical analysis indicates the power of shielding even more graphically. A 0.001-inch thick sheet of copper reduces a 30 MHz plane-wave field by 115 dB: this is equivalent to reducing the incident power density from 3 *trillion* mW/cm² to 10 mW/cm². Of course, the leakage from actual machines only roughly approximates the dictates of theoretical models.

Paul Ruggera and Dr. Daniel Schaubert, the authors of the report, issue a number of warnings about shielding techniques: (1) A small gap in the shielding can create significant increases in radiation leakage; (2) While grounding can be effective for reducing RF emissions, electric and magnetic fields must be measured to insure that a reduction and *not* an enhancement, has occurred; (3) Screened rooms that are used to prevent spurious radiation emitted by the sealers from interfering with other electronic devices, in accordance with FCC rules, "can greatly increase the power absorbed by the operators who are inside the rooms."

An alternative method of protecting workers by keeping them away from the radiation source is also reviewed. While such "exposure control" can be effective, it can also hurt the operator's performance, the authors conclude.

The National Institute for Occupational Safety and Health (NIOSH) is working on another booklet on control technology for regulating radiation exposures from RF sealers. NIOSH's David West said that the report was still in rough draft form and he could not predict when it would be ready for publication. "All our energies are directed at completing the criteria document on RF/microwave radiation," he explained. Work on RF sealers has been suspended until a draft of the document is out for external review, he said. According to recent estimates, the criteria document will not be ready for circulation until early next year.

The BRH report, *Concepts and Approaches for Minimizing Excessive Exposure to Electromagnetic Radiation from RF Sealers,* (Publication No. FDA 82-8192) is available from the National Technical Information Service (NTIS), Springfield, VA 22161. At press time, the NTIS order number had not yet been assigned. ●

More Siting Problems for Microwave Sources

Vernon, NJ, has joined a growing number of communities where public concern over radiation hazards has created problems for siting radiofrequency/microwave (RF/MW) sources. Some residents of this small town across the Hudson River from New York City are fighting to stop RCA Americom from building an additional microwave relay link for its satellite communications center in Vernon.

Plans for an imposing but low-power point-to-point tower

have mobilized residents in Vernon. They fear the antenna might create health hazards and are convinced that its approval will open the way for a flood of other towers. Citizens have successfully pressured the town planning board into hiring a consulting engineer to evaluate the antenna's effect on ambient radiation levels and into asking Americom for an environmental impact study. At an October 27 board meeting, RCA agreed to perform the study which should take four to six weeks to complete.

The proposed tower would be Americom's third relay link between New York City and its Vernon satellite communications station. It already has a point-to-point near the station and in Glenwood, NJ. Many other companies also have radiation sources in the area because it is the closest radio quiet zone to New York City and, therefore, a choice spot for communications links. Federal Communications Commission (FCC) records show there are over 50 microwave (4–12 GHz) point-to-point and satellite communications sources within five miles of Vernon. Along with Americom, the American Satellite Co. and Western Union each have a major satcom station there.

Americom maintains its new tower would meet the strictest exposure standards in the world and that it poses no danger. A company spokesman said, "We will continue to do our best to allay fears, then we will just have to see what happens."

The skepticism of many residents toward assurances from industry and the absence of federal RF/MW standards may make Americom's job difficult. People in Vernon have found the thousand-fold difference between the Soviet Union's standard (0.005 mW/cm²) and the new American National Standards Institute guideline (5 mW/cm² above 1.5 GHz) unsettling. Elise Kreindler, one leader in the fight against the tower, has explained, "all we are sure of is that there is no proof as to what is safe."

UPDATES

Biological Effects... EPA's Office of Research and Development is sponsoring an experiment that will test some of Professor H. Frohlich's theories. Frohlich, a physicist at the University of Liverpool in the UK, has long maintained that there are coherent emissions from cellular systems at millimeter wave frequencies. Now Professor Karl Illinger of the Department of Chemistry at Tufts University in Medford, MA, has devised a sensitive experiment to see if he can detect such signals. Under a $50,000 EPA contract, Illinger will investigate emissions in the 40–60 GHz band during his first year of research. EPA plans to award him another $50,000 for a second year of work if it has the funds....Dr. Joseph Lary and co-workers at NIOSH labs in Cincinnati, OH, have been studying the teratological effects of 27.12 MHz radiation. In a paper due to appear in the December issue of *Teratology,* the team presents the results of exposing rats to magnetic fields of 55 A/m and electric fields of 300 V/m—an SAR averaging between 11.1 to 12.5 W/Kg—at various times during the gestation period. They found significant increases in fetal malformations among the irradiated animals compared to the controls. With respect to possible mechanisms, they note: "Though most of the teratogenic and embryotoxic effects of RF radiation are probably due to temperature elevation caused by RF absorption in tissues, effects caused by 'nonthermal' interactions with the electromagnetic field cannot be ruled out." The authors conclude that "care should be taken to insure that pregnant women are not exposed to levels which exceed the current US occupational standard." Lary cites NIOSH's own surveys of RF sealer plants indicating that young women are routinely exposed to fields which are greater than the equivalent of 100 mW/cm². The old OSHA occupational standard was 10 mW/cm² and the new ANSI standard is 1 mW/cm² at 30 MHz....ONR is continuing to support Dr. James Bond's efforts to develop a model to explain Drs. Ross Adey and Carl Blackman's experimental findings on calcium efflux in brain tissue. Under a new $100,000 contract, Bond will devise some experiments to test his thermodynamic model, which he described at last June's BEMS meeting in Los Angeles. Bond and Carol Jordon recently left Jaycor of Alexandria, VA, to join Science Applications Inc. in McLean, VA.... Dr. Clay Easterly of the Oak Ridge National Laboratory, TN, has published a paper on "Cardiovascular Risk from Exposure to Static Magnetic Fields" in the July issue of the *Journal of the American Industrial Hygiene Association.* ... BRH's Division of Biological Effects recently issued its annual report for FY80. A copy is available for $10.50 from the National Technical Information Service, Springfield, VA 22161. Order No. PB82-215500.... Dr. Hans Selye died on October 16 in Montreal, Canada. Selye was well known for his studies on the physiological effects of stress.

Communications... Five sets of reply comments on the FCC's proposed RF/MW safety radiation rules were filed: they largely underscored earlier recommendations. (See *MWN,* September 1982.) The American Radio Relay League, GTE Service Corp., Motorola Inc., and the National Association of Broadcasters (NAB), all of whom had already submitted comments, supported FCC adoption of the ANSI standard until federal rules are set. The NAB also asked that broadcasters only be held responsible for their own transmitters rather than ambient levels at any given site. Commenting for the first time, Aeronautical Radio Inc. urged that, "based on criteria of intermittency and low power," the aeronautical mobile service be excluded from the proposed rules....The FCC's Office of Science and Technology has issued *A Comparison of Alternative Spectrum Regulatory Approaches.* Copies can be purchased from the Downtown Copy Center in Washington, DC, (202) 452-1422.... A notice summarizing FCC licensing policies for low-power microwave systems operating in the 22.0–23.6 GHz band was released by the commission October 15.... Comments submitted to the FCC on its plans to deregulate the use of FM subcarrier channels were overwhelmingly supportive. *Broadcasting* presents an overview in its October 25 issue ....More car telephones are on the way. Last month AT&T became the first company to win FCC approval for cellular mobile phone service. Its AMPS subsidiary will now build a cellular system for the metropolitan Chicago market.

Compatibility & Interference...The FCC is stepping up its enforcement of RFI violations. On October 7, the commission fined Coleco Industries Inc. $2,000 for failing to certify a computer game before marketing. According to an FCC staffer, one of Coleco's competitors reported the incident to the commission. After testing the unit, the FCC discovered that the games had a "somewhat higher than normal potential for interfering with television receivers." Coleco has since modified the game (model 2400) and won FCC authorization for its sale. The company will repair or exchange any units that still cause RFI....A day earlier, the FCC had fined Sonic Cable TV in California $6,000 for excessive signal leakage and failure to correct harmful interference to amateur radio communications. Last January, engineers from the commission's field office in Long Beach, CA, inspected Sonic's equipment and found it radiating in excess of the 20 microvolts/meter limit (at 10 feet) set by the FCC. Over the last two years, amateur radio operators had complained to the FCC that Sonic was disrupting signals in the two-meter band, 144–148 MHz.... In our March issue, we featured a story on an RFI incident at the Three Mile Island nuclear reactor in Middletown, PA. Two-way radios used by workmen had interfered with a gas measuring meter, falsely indicating the buildup of combustible gases inside the reactor building. At that time, spokesmen for General Public Utilities, the owner of the plant, refused to disclose the type of meter involved. Now we have learned that the meter in question was made by GasTech of Mountain View, CA. David West, the company's engineering manager admitted that the meter is not completely RF proof. He said that to upgrade it would require redesigning the unit, which does not

make sense since 99 percent of his customers are happy with it....The FCC has received more than 7,000 applications for low power television (LPTV) licenses. The commission is reviewing them to see if they might interfere with existing stations or with others whose proposals are still pending. Anyone applying to use LPTV directional antenna systems must submit radiation patterns to the FCC....On October 19–21, the FAA Technical Center and the FAA Ames Research Center sponsored a workshop on EMI effects on aircraft at the Boeing Aircraft Co. in Seattle, WA. The 100 attendees from the US and Europe heard 20 papers on the problem of aircraft-generated noise and its coupling with avionic systems, followed by solutions and validation techniques. A transcript of the presentations and open discussions is being prepared and should be ready early next year. For a copy, send a request on company letterhead to: Nickolus Rasch, ACT-340, FAA Technical Center, Atlantic City Airport, NJ 08405, (609) 641-8200 ....As for cars, W.B. Ribbens of the University of Michigan in Ann Arbor has published "Measurements of Electromagnetic Radiation from Automotive Ignition Systems" in the August issue of the *IEEE Transactions on Electromagnetic Compatibility*.... The Senate Foreign Relations Committee has released its report *Radio Broadcasting to Cuba Act* (Report No. 97-544) on H.R. 5427, which would authorize Radio Marti....Marcel Dekker, the New York City publishing company, has issued the second edition of *Electromagnetic Compossibility: Applied Principles of Cost-Effective Control of Electromagnetic Interference and Hazards* by Heinz Schlicke ($45.00).... In contract news, the Bureau of Mines has awarded A.R.F. Products Inc. of Raton, NM, $117,000 to study the interaction of radio transmissions with mine monitoring and control systems. And officials at the army's White Sands Missile Range, NM, are negotiating with GTE Products Corp. of Mountain View, CA, to investigate the vulnerability of selected army weapons systems to "special" EMI phenomena....Is RFI making it more and more difficult for E.T. to talk to us? So claims Dr. Carl Sagan and a galaxy of some of the world's most famous scientists. In a letter to *Science* (October 29) they ask for a coordinated search for signals from extraterrestrial civilizations: "Because of the growing problem of [RFI] by civilian and military transmitters, the search program will become more difficult the longer we wait."

Government...Work on a statement to reassure a wary public that there is no reason to fear very low levels of RF/MW radiation is still stalled at the National Telecommunications and Information Administration (NTIA). Two of the agency's advisory committees, the Electromagnetic Radiation Management Advisory Council (ERMAC) and the Frequency Management Advisory Council (FMAC) have been struggling over the right wording for nearly a year (see *MWN*, January/February 1982) and now it appears that the statement may never be finished. Though the committee members have nearly resolved their differences, there is not enough money to bring everyone back to Washington to iron out the remaining problems. In fact, ERMAC may soon become an advisory committee without an agency to advise: NTIA allocated *no* funds for ERMAC in FY83, which began on October 1, and no other part of the federal government has stepped forward to adopt it. (Some had hoped that the Office of Science and Technology Policy would come to ERMAC's rescue, but there have been no welcoming signs from the White House.) ERMAC's role in coordinating federal bioeffects research, a job it has had for the last ten years, is now slated to end on December 31. ERMAC member Dr. Sam Koslov called the situation "a shambles." If another agency is going to adopt and take over ERMAC and its coordinating function, there must be a lot of behind the scenes negotiations, but this is not happening, he said. NTIA is "absolutely insensitive" to the problems industry is having siting their communications stations, Koslov added on a note of exasperation. There is one encouraging sign on the horizon, however. Reliable sources indicate that a federal agency will soon pick up NTIA's contract for assembling digests of the RF/MW biological effects literature. Work on the digests was suspended earlier this year due to budget cuts (see *MWN*, July/August 1982).... It is official: the Bureau of Radiological Health (BRH) and the Bureau of Medical Devices (BMD) have been joined together to become the National Center for Devices and Radiological Health. The staffs of both bureaus remain largely intact in the center's Office of Radiological Health (ORH) and Office of Medical Devices (OMD). John Villforth, who had been the director of BRH, will now serve as the director of the center with James Benson as his deputy. Benson is also the acting director of ORH. The reorganization plan, published in the *Federal Register* on October 8 (47 *FR* 44614), is an interim one, with a final merger due in about six months. For the time being both offices will operate independently as the staff considers new ways of streamlining the center's management. One FDA official predicted that the two Offices of Compliances in ORH and OMD would be folded into one. The two-stage reorganization process will allow the center to operate with only minimum disruption, he said....One internal and anticipated change took effect at the same time: BRH's Division of Biological Effects has turned into ORH's Division of Risk Assessment....BRH's (now ORH's) Technical Electronic Product Radiation Safety Standards Committee (TEPRSSC) has decided not to hold a meeting in 1982, one is planned for next year, though no date has been set. Dr. Zory Glaser is stepping down as executive secretary of the committee to join the new risk assessment group; Dr. Melvyn Altman will fill in for the time being....Other personnel changes include: Dr. Wordie Parr, the chief of NIOSH's Physical Agents Effects Branch in Cincinnati, OH, has announced that he will retire on December 29. No replacement has been named. Mark Cowan, deputy director of OSHA, has gone to work for Labor Secretary Raymond Donovan as chief of staff. Dr. Stephen Lukasik has resigned as FCC's chief scientist to join the Northrop Corp. And Dr. Robert Kamper has been appointed the director of NBS' Boulder, CO, laboratories. Kamper, a physicist, had been chief of the Electromagnetic Technology Division at NBS since 1978....*Broadcasting* magazine discloses in its October 25 issue that the General Accounting Office (GAO) is investigating charges of malfeasance at high levels of NTIA. The GAO will look into the use of travel money, among other items.

Litigation & Policy...New York Telephone lost its final bid to appeal Mrs. Nettie Yannon's workers' compensation award this September when the NY State Court of Appeals refused to consider the case. Yannon's compensation claim alleged her husband's illness and eventual death were the result of microwave radiation exposure he received while working on TV relay equipment for the phone company. Commenting on the case, New York Telephone attorney Saul Schier said any future suits "will have to be judged individually: this is just not a precedent-setting case." Angello Gucciardo, Yannon's lawyer, called the case "a landmark decision," adding that "it clearly demonstrates that constant exposure to microwave radiation can be harmful and should be avoided." Mrs. Yannon is appealing the dismissal of her suit against RCA, the manufacturer of microwave equipment her husband worked with. Her attorneys, Jerome Ellis and David Paully, filed the appeal in the NY State Supreme Court Appellate Division after a state supreme court judge in Richmond County ruled that the statute of limitations had expired before Yannon filed her $3.5 million negligence and breach of warranty suit. The judge dismissed the case in a pre-trial hearing in July. (See *MWN*, July/August 1982.)... Raytheon's John Osepchuk reports that the legal and policy seminar on RF/MW radiation he organized was "very productive." About 100 representatives from the communications, electronics and appliances industry attended the meeting at the Homestead in Hot Springs, VA, October 27–29, and agreed on the concept of an alliance to respond to the public's "irrational" fear of RF/MW radiation (see *MWN*, October 1982). "The organizing committee will now explore various possibilities for the alliance," he said.

Measurement... Litton Microwave has asked NBS to set up a program to improve the accuracy of meters used to measure leakage from microwave ovens. Litton representatives had raised the possibility of accrediting laboratories that market power density meters at last July's National Voluntary Laboratory Accreditation Program (NVLAP) workshop on electromagnetic calibration. The proposal was supported by BRH. There are at least two approaches NBS could now take: set up a new LAP for survey meters operating at 2450 MHz or set up a Measurement Assurance Program (MAP). A MAP is much less formal than a LAP and is therefore the more likely option at the moment. A spokesman for Litton Microwave in Sioux Falls, SD, refused to comment on the proposal saying that doing so would

divulge confidential business information. NBS has not responded to the request.... NBS engineers have successfully tested a small-scale model of a microwave horn, which, when full-sized, will serve as a transfer standard for satellite communication antennas operating in the 240–400 MHz frequency range. With this new horn and a newly developed extrapolation technique, NBS has found a way to overcome the calibration problem associated with broadbeam signals, characteristic of this frequency range, and their ground reflections. The NBS standard will be used to calibrate antennas in the military's satellite communications systems as well as private sector VHF/UHF antennas....A team from the Bioacoustics Research Laboratory at the University of Illinois, Urbana, has developed an automated Crawford cell exposure system for irradiating experimental animals in the 225–500 MHz band for incident power densities of 2.5–50 mW/cm². Writing in the September issue of the *IEEE Transactions on Instrumentation and Measurement,* they describe how the system can compute instantaneous values of the whole-body average specific absorption rate (SAR).

Medical Applications...The National Cancer Institute (NCI) has issued its request for proposals on "Comparative Clinical NMR Imaging Studies." The institute's new Diagnostic Imaging Research Branch wants to develop criteria, guidelines and protocols to evaluate the potential of NMR imaging systems in diagnostic applications as well as run clinical trials on at least 200 patients with various types of pathologies. One of the study's objectives is to compare NMR with other diagnostic techniques. Proposals are due on December 17, and NCI expects to make awards to a number of institutions next June.... The October issue of *Diagnostic Imaging* features a report on the *First Annual Meeting of the Society of Magnetic Resonance in Medicine,* held in Boston last August....The first issue (dated July) of the *IEEE Transactions on Medical Imaging* is out. Subscriptions cost $8.00 for IEEE members and $50.00 for others. Contact: IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854.... Universal NMR Inc. intends to buy Fonar Corp.'s NMR whole body scanners for mobile uses and become their exclusive distributor. The agreement, which is contingent on Fonar receiving FDA approval for its units, could be worth up to $31 million if Universal buys 25 scanners. Investors in Fonar stock, who no doubt thought the shares would shoot up, must have been disappointed by an October 15 column in the *New York Times.* Robert Metz quoted a Wall Street analyst as saying that Fonar shares are "substantially overvalued." The analyst saw little advantage in being the first to develop a new technology: for example, the original producers of CAT scanners are now out of business. Nevertheless, the bulls seem to have had the upper hand. The price of Fonar shares rose nearly 20 percent in the last two weeks of October....Electrobiology Inc. may be one of tomorrow's blue chip companies, according to a recent appraisal by Morgan Stanley & Co. The upbeat outlook for the still small company that uses pulsed electromagnetic fields to heal fractures is in the October 13 *Wall Street Journal*....Those unable to attend the *Second Annual Meeting of the Bioelectrical Repair and Growth Society,* held in Oxford, UK, September 20–22, can order a copy of the meeting's transactions for $17.50 from H. Schnitzer, BRAGS, 425 Medical Education Building, 36th and Hamilton Walk, Philadelphia, PA 19104. The booklet contains abstracts of the 95 papers presented at the conference....NCI is in the process of reviewing proposals for its hyperthermia quality assurance program. It expects to announce contract winners in early February.... Meanwhile, the institute has made some additional awards to those hospitals participating in NCI's hyperthermia evaluation program: University of Arizona Medical Center, $37,550; M.D. Anderson Hospital, $46,185; MIT-New England Deaconess Hospital, $57,385; Stanford University Medical Center, $64,385; and University of Utah Medical Center, $54,385. An NCI staffer said that the objective is to ensure consistency in gathering data and calibrating the various systems used by the participating hospitals. (See *MWN,* April 1982.)...F. Kristian Storm and co-workers at the UCLA School of Medicine have published a paper, "Clinical RF Hyperthermia by Magnetic-Loop Induction: A New Approach to Human Cancer Therapy," in the *IEEE Transactions on Microwave Theory and Techniques,* August 1982....Professor Padmakar Lele of MIT described his work on hyperthermia, especially his computer focused ultrasound system, at an October 21 meeting of the New York Academy of Sciences.

Military Systems...The IIT Research Institute has scheduled a technical symposium, *Ecological Monitoring Program: ELF Communications System,* to be held at the Telemark Lodge in Cable, WI, on November 9. The purpose of the meeting is to determine "if low-level, long-term electromagnetic fields produced by an ELF communications system affect plant and/or animal populations, or otherwise result in community or ecosystem level changes of importance." According to present plans, pre- and post-construction studies will be done. There will be a meeting of the subcontractors the following day. For more information contact: Dr. J.E. Zapotosky, IITRI, 10 West 35th Street, Chicago, IL 60616, (312) 567-4000....On September 24, the navy awarded GTE Sylvania $5.25 million for a full-scale development model of the ELF system. Last April, the navy paid GTE $6.85 million for preliminary development work on the project ....The navy and DARPA blue-green laser program, an alternative submarine communication system, is also moving ahead. According to the October 18 *Aviation Week & Space Technology,* Rockwell International's Defense Electronics Operations will design, build and test a submarine receiver under a $3 million contract. The same issue reports that RCA Missile & Surface Radar in Moorestown, NJ, received a $370.4 million contract to provide and support the Aegis weapon system for the navy's fifth, sixth and seventh Ticonderoga-class guided-missile cruisers.

Ovens...The Federal Trade Commission (FTC) has accused Amana Refrigeration Inc. of marketing its microwave ovens with "false, misleading and unfair" advertising. The commission complained that Amana had claimed that its oven was the only one of six to pass four tests conducted by an independent laboratory at the Illinois Institute of Technology Research Institute. In fact, the FTC said that seven ovens had been tested and that the Panasonic model had also passed. The commission also charged that Amana had misled consumers when it claimed that a survey of microwave oven owners had rated Amana "best quality." The FTC said that, on the contrary, the survey indicated that "the vast majority of owners of other brands did not rate Amana 'best quality.'" A spokesman for Amana in Amana, IA, responded: "Our ads are true: we did not mislead the public." He maintained that the Amana Radarange is the only oven to earn an exemption from BRH's rules requiring a warning label. In any case, he added, the ads stopped running two years ago and Amana beleives the FTC is wasting its resources by pursuing this case. The FTC has scheduled a hearing before an administrative law judge for November 29 in Washington, DC....On another front, the FTC has released an amended order against Litton Industries Inc. for falsely advertising its ovens. The company had run ads claiming that independent service technicians preferred Litton's microwave ovens, when it had only interviewed authorized Litton service agents (see *MWN,* February 1981). Litton had appealed an earlier FTC order that prohibited the misrepresentation of survey and test data to the US Court of Appeals for the Ninth Circuit. The revised order, which appears in the September 28 *Federal Register* p. 42551, bans Litton from misrepresenting survey data only. If it does, the company faces a possible $10,000 fine.... Do microwave ovens "abuse" food? So claims George Claytor Jr., the president of Amtrak. According to the October 7 *New York Times,* Claytor is ordering the removal of all microwave ovens from Amtrak trains; sandwiches will be heated with toaster ovens in the future....Cober Electronics Inc. of Stamford, CT, has won a $106,000 contract from the US Army Natick R&D Labs, MA, for a drying system using microwaves and radiated heat sources.... Factory shipments of microwave ovens are still lagging behind last year. The Association of Home Appliance Manufacturers reports that 2,841,000 units were shipped through the end of September, down nearly 11 percent from the first nine months of 1981.

Power Lines...The New York State Overhead Power Lines Project has suspended work on the one epidemiological study it funded last spring. The project had provisionally approved Dr. Samuel Kaplan's $281,000 project on "Historical Cohort Mortality Study of Electrical Utility Workers Exposed to Strong Electromagnetic Fields," and had awarded him $40,000 to look for potential study populations. According to Greg Alvord, the project's scientific research coordinator, the decision to start a new epidemiological study was reached after questions were raised over the way the cohorts had been defined. He said that a new request for proposals (RfP) would be issued. Reached

at his office at SRI International in Palo Alto, CA, Kaplan said that he would reapply if he thought he could satisfy the project's new specifications. Alvord added that he was completing negotiations with a consultant to see if it is still possible to reanalyze Dr. Nancy Wertheimer's data on childhood cancer and power line radiation (the paper was published in 1979). On the basis of the consultant's report, the project's scientific advisors will decide whether to sponsor another analysis or to issue an RfP for a completely new replication study....About 80 people came to Philadelphia, PA, on October 30 to attend the American Institute of Medical Climatology's conference on high voltage direct current (HVDC) power lines and the biological effects of air ions. NBS's Dr. Ronald McKnight and GE's Dr. Gary Johnson described how to take measurements near HVDC lines, especially for electric field strengths and space charge densities. Johnson has been running experiments at GE's HV Transmission Research Facility in Lenox, MA. In an appraisal of the research on the bioeffects of air ions, Dr. William Bailey of Rockefeller University in New York City said the data relating changes in serotonin levels to air ion concentrations were "fairly fanciful." He recommended that future ion research adopt new approaches. In response to a question from the audience, he said that he knew of no evidence indicating that VDTs depleted environmental ions. The proceedings of the meeting will be prepared and should be ready by the end of the year. Contact: AIMC, 1023 Welsh Road, Philadelphia, PA 19115.

Satellite Communications... A tentative timetable for Teleport, a massive satellite communications complex planned for Staten Island, NY, expects a City Planning Commission hearing on February 15, 1983, and a final decision from the Board of Estimate on April 21. Meanwhile, Teleport's environmental impact statement is overdue and is not expected out for public review before December....NASA has received an added $20 million for 20/30 GHz communications satellites in its final FY83 budget, according to the October 11 *Aviation Week & Space Technology*.... Comsat's Satellite Television Corp. (STC) has ordered two direct business satellites (DBS) from RCA. The $113 contract is one step in STC's plan to begin DBS service in 1986....STC and United States Television are wrangling before the FCC over who will be the first to offer DBS service. For a rundown on the fight, see the October 25 *Broadcasting*.... The private satellite service market is expected to climb from $146 million last year to $2.9 billion by 1991 according to a Frost & Sullivan report. For more information on private satellite networks (Report No. 1063), contact F&S Inc., 106 Fulton Street, New York, NY 10038, (212) 233-1080. Frost & Sullivan has also prepared reports on communications satellite systems markets in developing countries (No. W565), in North America (No. A954) and in Europe (No. E564).

Standards...A second public hearing on Massachusetts' revised draft standard for general population on RF/MW exposures is scheduled for December 2 in Holyoke. The first hearing will be held in Boston on November 29. For information, contact the Radiation Control Program, 600 Washington Street, Room 770, Boston, MA, 02111, (617) 727-6214. Written comments on the draft are due December 13.

VDTs... Dr. Hari Sharma of the University of Waterloo in Ontario, Canada, has recommended shielding the fly-back transformers in VDTs and not allowing pregnant women to work at unshielded machines. In a May 29 report, Sharma states he found "very high" power densities of 17 kHz (very-low-frequency) radiation and its harmonics were emitted by VDTs at the Ontario legislative library in Toronto. Sharma noted that, "our observations on a large number of VDTs have indicated that a *fly-back transformer* emits 14-17 kHz radiation along with its harmonics up to 1 MHz." The measured X-ray levels were below 0.02 mR/hr, which Sharma noted provided a "large safety factor." The RF/MW readings were taken with a RAHAM 4 broadband meter, which measures 200 kHz to 26 GHz radiation. Sharma explained that at 15 kHz he multiplied the meter reading by 25 to get the "true reading" because the meter "detects low frequency radiation with reduced [4 percent] efficiency." He also took one of the library's GEAC terminals back to his laboratory for further testing and determined that "there is a very high level of leakage of radiation (800 mW/cm^2)." The library's director requested the tests this spring out of general concern for two pregnant employees. The women were given alternate work and have since had healthy babies. ... At the request of the British Columbia Hospital Employees' Union, Sharma has also tested VDTs at Surrey Memorial Hospital in Vancouver where six out of seven pregnancies among VDT workers in the accounts department had adverse outcomes. (See *MWN*, July/August 1982.) According to the union's Jean Greatbatch, Sharma measured high levels of low frequency radiation coming from the department's plastic bodied VDTs. Sharma visited the hospital in October and has taken one of the units back to his lab for further testing. He found no detectable emissions from newer VDTs of a different model in the hospital's medical records department. A final report is due in late November. Meanwhile, hospital administrators have hired Professor Bill Guy of the University of Washington, Seattle, to test another of the machines....The Connecticut Legislature's Labor and Public Employees Committee is investigating the health effects of VDTs. The committee held a hearing on October 13 and is now considering further action. Among those testifying were Vico Henriques, the President of the Computer and Business Equipment Manufacturers Association in Washington, DC, and Betty Tianti, representing the Connecticut AFL-CIO. Henriques stated that "there is no danger from radiation from [VDTs]." Tianti asked that the legislature require the collection and reporting of data on pregnancies of women using VDTs. Women should be offered the option of doing non-VDT work while pregnant, she advised. According to committee staff member Joan Lennon, Senator Mike Skelley (D-35th District) instigated the investigation. It is not clear at this time what action, if any, the committee might take next.... M.J. Lewis, the director of the South Australian Health Commission's Occupational Health and Radiation Control Branch, has published a survey of general health problems and spontaneous abortion rates among VDT operators. (*Community Health Studies, VI*, 130, 1982) Lewis and co-workers collected questionnaires from 279 VDT users and 110 current non-users in 1978 and found "no convincing evidence of an association between the use of VDTs and general health disturbances," though "there is the *suggestion* of an association with poor sleep and dizziness." An analysis of reported miscarriages among VDT users indicated "no statistically significant relationship" between the machines and the pregnancy problems. They did note, however, that the sample size was small and "the statistical test therefore not powerful." ... Australia's National Health and Medical Research Council has issued an *Occupational Health Guide: Visual Display Units*, (VDU-82-93), June 1982. The guide, which covers ergonomic issues, states that there "is no scientifically acceptable evidence that the use of VDTs damages the eyes or eyesight or imposes any risk from radiation."... Working Women's *International Conference on Office Work & New Technology* drew an overflow crowd in Boston October 28-29. Over 350 people from business, labor and universities met to exchange information, listen to panels and attend special issue workshops. At the low-level radiation workshop, as elsewhere, people shared a general concern for worker safety while taking different tacks on solving problems. Workshop leaders Robert Dematteo from the Ontario Public Service Employees Union and Mary Sue Henifin from the Women's Occupational Health Resource Center at Columbia University agreed that transferring pregnant women from the sets is a good idea for the time being. DeMatteo stressed the need for shielding, Henifin said solutions to VDT radiation questions will have to be political rather than scientific. Proceedings of the conference will be available next year....Trade union representatives from the US and Canada took advantage of the gathering and held a caucus on office work policy issues the day after the conference. About 100 people joined the general discussions on the effects of new technology in the work place and on worker health and safety, according to one attendee. ●

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USSR *(continued from p. 1)*

USSR RF/MW cooperation program, said that both countries should be in a position to turn the power on by the beginning of the year.

Occupational Exposure Standards

In telephone interviews, all four said that Soviet scientists had told them that a new occupational health standard for RF/MW radiation had been adopted. Barnes and Wachtel reported that the new standard specifies a maximum energy dose as a function of exposure time. The maximum exposure level in the 300–3000 MHz band is governed by the formula:

Maximum Exposure (uW/cm²) x Exposure Time (hr) = 200 uW-hr/cm²

The equation only applies for exposures of more than 12 minutes. Therefore, the standard is 25 uW/cm² for 8 hours, 50 uW/cm² for 4 hours, 100 uW/cm² for 2 hours, and an absolute maximum of 1 mW/cm² for shorter periods. In contrast, the new ANSI standard allows 1 mW/cm² exposures to 30–300 MHz radiation for unlimited amounts of time and 5 mW/cm² above 1500 MHz.

From 50–300 MHz, Swicord added, the exposure of Soviet workers must not exceed 5 V/m and 0.15 A/m for electric and magnetic fields respectively, and for 30–50 MHz the limits are 10 V/m and 0.3 A/m. Swicord is the chief of the electromagnetic radiation branch in the Bureau of Radiological Health's (BRH) Division of Risk Assessment.

Future Soviet exposure standards for the general population will not be limited to continuous wave radiation. Barnes said that one member of Professor Mikhael Shandala's group at the Institute of General and Communal Hygiene in Kiev told him that they were in the process of introducing modulation characteristics into the exposure limits for the general public.

Barnes and Wachtel explained the current approach to standard setting in Kiev: they are specifying a different exposure standard for each class of electronic device. Thus, there is one standard for landing radar on aircraft and another for microwave ovens. Barnes noted that the oven standard, though specified in a different form from BRH's, is essentially the same as the US leakage limit. He added that the Kiev group was developing a standard for the communications industry and had initiated a five-year project to set exposure standards for civil aviation radar.

The American visitors were struck with the Soviet commitment to coordinating RF/MW research. That responsibility lies with Professor Inal Akoev, the deputy director of the Institute of Biophysics in Pushchino, a scientific research center south of Moscow. Wachtel found that there was cooperation between the Ministry of Health and the Academy of Sciences, a rare event because the two units usually work independently.

(The Soviet effort stands in contrast to current US moves to reduce funding for RF/MW bioeffects research (see *MWN*, July/August 1982) and to dismantle its coordination; see Updates: Government, p.5.)

US-USSR Cooperation

The joint US-USSR experiment is developing into a truly cooperative venture. Researchers in each country will use American rats and food, and the rats will live in Soviet plexiglass cages. BRH's Howard Bassen is scheduled to go to Kiev early next year to help Shandala's group with their dosimetry. In the US, the experiment will be carried out at both NIEHS and BRH. NIEHS wil run behavioral, physiological and neurochemical tests, while BRH will only look at behavioral effects.

A meeting between the participating Soviet and American scientists has been scheduled for next June, according to McRee. That way, he said, the Russians can attend the Bioelectromagnetics Society's annual meeting on June 12 in Boulder, CO.

When asked what research most impressed him during his trip, Swicord cited the work of Professor Y.A. Kolodov of the Institute of Higher Nervous Activity in Moscow and Professor K.V. Sudakov, chief of the P.K. Anokhin Institute of Normal Physiology in Moscow. Kolodov is investigating the ability of humans to emit and sense magnetic fields. Sudakov is working on ways to better withstand stress by exposing experimental animals to electric fields. This latter project is especially interesting, Swicord said, given some scientists' belief that electromagnetic fields can cause stress.

In response to the same question, Barnes and Wachtel referred to work on artificial membranes, isolated frog nerves and computer modelling. Barnes made special mention of investigations of the impact of magnetic fields on photosynthesis and the effects of long-term exposures to non-ionizing radiation on leukocyte mobility. ●

NIOSH *(continued from p. 1)*

workers, especially in Canada, have already won the right to do alternative work during pregnancy.

Jay Bainbridge, the assistant director of NIOSH's Division of Surveillance, Hazard Evaluation and Field Studies, confirmed that the study would go forward if the negotiations were successful. While noting that there is no evidence of any radiation hazard from VDTs, he said, "We would like to resolve this issue once and for all." Bainbridge and Rosenberg are in the same division at NIOSH.

Rosenberg said that the study population would be large enough to be statistically reliable. He added that one advantage of the proposed cohorts is that all the pregnancies would be monitored by one health care agency, which would ensure consistency in the study.

Meanwhile, a representative from another part of NIOSH has been assuring VDT operators that the machines do not cause miscarriages. According to a story in the October 21 Toronto *Star,* Dr. Michael Smith told members of the International Information/Word Processing Association that while the sets can cause a number of physical and psychological ailments, radiation hazards were not among them. Smith listed eye and muscle strain and stress as the most serious complaints. Smith, who works in NIOSH's Division of Biomedical and Behavioral Sciences, was out of the country and unavailable for comment.

Word of NIOSH's plans coincided with calls for an epidemiological study of pregnant operators from the Newspaper Guild in Washington, DC. The guild is already sponsoring a study at the Mount Sinai School of Medicine in New York City: VDT users at seven guild locals have been asked to complete a questionnaire on potential health impacts. Dr. Arthur Frank, the study's director at Mount Sinai, said that as far as pregnancy problems are concerned, the responses to his study could only generate hypotheses but not test them. "It will give us clues, but not answer any questions," he said.

In a related development, a Canadian task force on computer technology recommended that VDT operators should be allowed to do alternative work during pregnancy without any loss in pay (see story on p.2). ●

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Microwave News invites contributions to *From the Field*, our monthly column featuring news and opinions from the RF/MW community. Letters from readers are also welcome.

OSHA Stops Work on RF/MW Standard; Enforcement Stalled

The Occupational Safety and Health Administration (OSHA) has cancelled plans to develop a new safety standard for worker exposure to radiofrequency and microwave (RF/MW) radiation. In addition, informed sources report that OSHA plans to keep its 10 mW/cm^2 *voluntary* standard in place, thereby barring the agency from enforcing any RF/MW exposure limits.

One OSHA official, who asked for anonymity, said that the state of the RF/MW program is "as bad as it possibly can be."

Word of OSHA's decision to suspend work on a new standard came without explanation or publicity in the agency's most recent regulatory agenda, its semi-annual work schedule. OSHA only noted that its review of non-ionizing radiation had been completed in August 1983 and that RF/MW radiation had been "withdrawn" from its timetable for future action during the next year.

The decision was made by OSHA Administrator Thorne Auchter, according to Chris Graybill, a public information specialist at the agency. No analyses or other details of the decision are available, however. Graybill explained that OSHA did not have enough resources to develop all the health standards it wanted and that other standards had been given a higher priority than non-ionizing radiation.

(continued on p. 12)

Radiation Accident at Alaska BMEWS Radar Station

Six men were overexposed to radiation while working on a tracking radar at Clear Air Force Station near Fairbanks, Alaska, on September 14. The radar, which is part of the Ballistic Missile Early Warning System (BMEWS), was accidentally turned on as the men were doing routine maintenance work.

Six welders and technicians were 80 feet above the ground on the radar's antenna when the power went on. They realized the radar was turned on when they noticed that one of their flashlights was hot to the touch and another flashlight was blinking, even though it was switched off. There were also two electricians at the base of the radar at the time of the accident.

It is not yet known whether human or machine error was responsible for the accident.

(continued on p. 2)

Radiation Accident (continued from p.1)

Two of the six men were hospitalized following the accident for nausea, headaches, dizziness, extreme fatigue and memory loss. Both have been released. Four of the six have been examined by doctors at the Air Force School of Aerospace Medicine at Brooks Air Force Base (AFB) in San Antonio, TX.

A number of interviews with Richard Eldridge, one of the exposed workers, revealed there was a gross misunderstanding about the nature of radar radiation at the air force station and there were extensive delays in providing the exposed men with expert medical attention. Much of Eldridge's story was confirmed by one of his co-workers.

Few Official Details

The air force and its contractor at Clear have released few details about the accident. All requests for information from the air force are being directed to the North American Air Defense (NORAD) Space Command in Colorado Springs, CO. Kay Cormier, a public affairs officer at NORAD, told *Microwave News* that initial tests indicated the workers' exposure was "not life threatening," and that the medical condition of the exposed men will be monitored over the next six months.

Cormier said that the air force's best "guesstimate" was that the radar was turned on for no longer than seven minutes and that the power levels were above the air force's 10 mW/cm^2 safety standard.

The radar at Clear is maintained and operated by FELEC Services, Inc., a subsidiary of Federal Electric Corp., which in turn is owned by ITT. Four of the exposed men are FELEC employees; the two others were flown in to inspect the radar dish from McClellan AFB in Sacramento, CA, where they are civilian employees of the air force. An ITT spokesman said medical tests indicated that the exposed men could return to work and that they did. He also said their health would be monitored for at least six months.

The workers believe their radiation exposure was much more serious than the official statements suggest. Many of them are anxious about their injuries and suspicious of the treatment they received.

Misled by Radiation Badges

Eldridge, aged 40, is a welder who has worked at Clear for nine years. He was on the radar dish when the power was turned on and was later hospitalized. Eldridge accused FELEC of being lax and misinformed in the way it protected the workers. The safety officials at Clear did not know the difference between ionizing and non-ionizing radiation, he charged.

Eldridge said that he and his co-worker John Jessup had been repeatedly assured for *eight days* after the accident that their radiation badges would indicate the degree of their exposure. A week after the accident, Eldridge and Jessup were notified that lab tests on the badges showed they had not been overexposed. It was not until the following day, at a meeting with air force and FELEC personnel, that they were told the badges only measured exposures to ionizing radiation. Eldridge said that during the seven years he had worn a badge at Clear he had been told that it measured both ionizing and non-ionizing radiation.

Immediately after the accident, a supervisor wanted Eldridge and Jessup to return to work on the radar dish. They refused. The six men and the two electricians were later given a "Class C" examination by the company nurse. Eldridge described the exam as a check of their vital signs and a visual inspection of their bodies. He said that they were found to have elevated body temperatures and high blood pressure. The shoulders and back of Karl Kepler, one of the technicians from Sacramento, were red and sore. Eldridge had a wrist burn from radiation heating of the metal buttons on his denim shirt.

The next day, the men reported to work as usual. Six hours later, all eight men were sent to Fairbanks Memorial Hospital, where they were examined in the emergency room. Eldridge said that the doctors in Fairbanks told him that they had no experience with radiofrequency radiation injuries.

Jessup was hospitalized and the other seven men were sent home. On the 16th, two days after the accident, Eldridge checked into the hospital, complaining of headaches and partial loss of sight and memory. Eldridge was released on the 18th; Jessup stayed in the hospital for a week.

The symptoms reported by the workers are in general agreement with those reported after other radar accidents. For example, at a NATO workshop in 1981, Dr. Bernard Servantie detailed three case histories of radar overexposure. In general, the cases show that radar radiation can lead to overheating, dizziness, nausea, headaches, loss of memory and general asthenia (loss of strength and energy). Servantie is a physician with the French navy, based in Toulon. (Note that the frequency and power levels associated with a given radar can vary greatly.)

Very little is known about the long-term consequences of overexposure to radar radiation. The results of the only US epidemiological study (of navy radar workers) were inconclusive. A number of former radar technicians have won out of court settlements for their injuries, which include cataracts, deafness, pancreatic cancer, neurological disorders and impotence (see *MWN*, December 1982, January/February 1983).

Delays in Expert Medical Care

The men were not offered medical attention by doctors familiar with radiofrequency and microwave radiation until September 23, nine days after the accident. And then, according to Eldridge, they were told that they would have to wait for two more weeks because of a personnel shortage at the School of Aerospace Medicine at Brooks AFB.

The six men who were on the radar were given the opportunity to go to Brooks but two had no faith in the air force's objectivity and refused. As one observer familiar with the accident put it, "They did not think they would get a fair shake."

The two electricians who were at the base of the radar at the time of the accident were not thought to have been overexposed to radiation and were not invited to go to Brooks.

Eldridge and three of the other workers arrived at Brooks between the 10th and the 12th of October. By the 22nd, all the tests had been completed. Eldridge said that his loss in vision was documented at Brooks, as was a partial loss in hearing which developed two weeks after the accident.

According to Eldridge, one of the doctors at Brooks suggested that his medical condition might be attributable to hysteria, anxiety, life-style or depression. The physician never mentioned radiation as a potential cause of his illness.

Eldridge and some of the other men are now seeking additional medical opinions. Since he left Texas, Eldridge has consulted with Dr. Milton Zaret, an ophthalmologist in Scarsdale, NY, who is an expert on non-ionizing radiation.

Lt. Col. George Schwender, chief of the flight medicine branch of the clinical sciences division at Brooks, was in charge of examining the workers. In a telephone interview, he said that the medical reports had not yet been completed. He added that each man would receive a copy of the medical tests for his own use.

A detailed report on the accident is being prepared by the air force's Inspection and Safety Center at Norton AFB in California. It should be completed in December, NORAD's Cormier said.

(Note that: The air force's standard governing exposures to radiofrequency radiation, No. 161-9, cites rules for the "medical investigation of incidents and accidents." In part, it states: "It is essential that every suspected or actual overexposure to RF radiation be thoroughly investigated and evidence of injury or absence of injury thoroughly documented....Personnel who may have been overexposed should be evaluated...The evaluation should be made at the nearest USAF medical facility as soon as practical after the event.")

Accident Simulation

A team of "bioenvironmental engineers" was assembled at Clear on September 22 to reconstruct the incident with the help of the workers. According to Cormier, the simulation indicated that the radar was turned on for no longer than seven minutes and that the exposure levels were above 10 mW/cm^2. She would not elaborate on how high the levels might have been.

Eldridge provided a different and more extensive description of the radar tests and their results. He said that he and his co-workers believe the radar was on a *minimum* of eight minutes and possibly as long as 17 minutes. Their estimate is based on an inspection of the station's power plant records, which indicated that there was a power surge at the time of the accident that lasted 17 minutes.

According to Eldridge, the air force estimated that the men were exposed to power densities of 40-45 mW/cm^2, but that technicians present during the simulation thought that the exposure levels were closer to 135 mW/cm^2. Eldridge stressed that the air force did not deny that this higher exposure was possible.

Some of the technicians told Eldridge that the air force was making the most conservative assumptions in recreating the incident and estimating the degree and extent of exposure. The net effect was to minimize the severity of the accident, he argued. For instance, the simulation was run with the radar operating at a lower power setting than was the case during the accident; Eldridge believes the wrong correction factor was used to extrapolate the exposures from the lower to the higher power setting.

Eldridge criticized the air force for taking eight days to assemble the simulation team in an effort to understand what had happened to him and his co-workers, even though the two experts who ran the tests were already in Alaska.

Unreported Accidents at Clear

David Clarke, an electrician who spent 19 years at Clear until he was terminated in 1979, told *Microwave News* that "there have been numerous unreported accidents at the air force station." Clarke said that radiation safety was essentially ignored while he was at Clear. When radiation levels were measured in the last years he was there, he added, levels over 10 mW/cm^2 were often found. Describing one incident, Clarke said that "painters found sparks shooting out from their paint brushes."

Clarke is suspicious about a possible cluster of brain tumors among a small number of men he worked with. He said that there were three deaths from brain tumors among the twelve men in his department during approximately a seven year period. (There was some turnover among the men during this time.)

Clarke, now a Seattle, WA, resident, has cataracts on both the posterior and anterior sides of the lenses of his eyes. He also suffers from retinitis pigmentosa, a hereditary condition that limits his field of vision.

AN/FPS-92 Radar

The tracking radar, designated AN/FPS-92, operates at a number of frequencies in the ultra high frequency (UHF) band (300 MHz-1 GHz), with an output power at megawatt levels. It emits 27 pulses per second. The radar has a maximum range of more than 3,000 miles. The AN/FPS-92 is an improved version of the AN/FPS-49 radar which is in operation at the two other BMEWS sites in Greenland and in the United Kingdom.

The radar is housed in a golf ball shaped dome. It has a diameter of about 92 feet, while the dome has a diameter of 140 feet. There was an AN/FPS-49 installation in Moorestown, NJ, next to the New Jersey Turnpike, but the unit was phased out in 1974 and later torn down.

In addition to the tracking radar, there are three stationary screens that also emit radar radiation at Clear. Each of these are, as NORAD's Cormier phrased it, "as big as football fields." ●

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HIGHLIGHTS

Newspaper Guild Study Confirms VDT Health Problems

VDT users are likely to suffer vision problems, musculoskeletal disorders, headaches and stress according to a study sponsored by the Newspaper Guild. Dr. Arthur Frank, the study director, also concluded that the potential risks of cataracts, skin rashes and reproductive problems cannot be determined on the basis of current scientific data, including his own research.

Frank announced these findings at a congressional hearing on October 18. He told the subcommittee on health and safety of the House Committee on Education and Labor that his survey of 1,047 guild members confirms that eye problems, neck, shoulder and low back pain all "clearly result" from ergonomic factors. These same factors may also cause personality changes, irritability and sleeping problems.

The new study findings confirm previous research by the National Institute for Occupational Safety and Health (NIOSH) (see *MWN*, May 1981).

Frank's data also agree with the results of a literature review done by the National Academy of Sciences (see *MWN*, July/August 1983). Frank and the NAS study panel disagree on how to interpret the findings, however. Frank testified in support of further study. "What this data tells me," Frank said in an interview, "is that the three things we need most are more research, more research and more research."

NAS discouraged further research on VDT safety, while recommending improved workstation design and management practices. The study panel urged that "competing priorities in the field of occupational health be carefully considered" in planning research related to VDTs.

Guild President Charles Perlik, Jr., warned that operators have "lingering and lasting fear and concern" that can be dispelled only by "ongoing, long-term research." David Eisen, research director for the guild, told the subcommittee that the Occupational Safety and Health Administration (OSHA) should be directed by Congress to set ergonomic standards. Similarly, Frank called for an interim standard requiring regular work breaks for operators.

After hearing the testimony, subcommittee chairman Joseph Gaydos (D-PA) acknowledged that "we have a problem" and announced that the subcommittee's work on VDTs will continue. Under consideration are more hearings, a staff investigation and informal discussions with experts in the field.

Other study findings include:

- The "constellation" of ergonomic problems confirmed by the survey may be responsible for a greater loss of work time among VDT users compared to non-users, a problem of "potentially major magnitude with regard to the economics of work."
- A link between VDTs and cataracts is possible. One site produced five cases of cataracts in the five years prior to the survey. Frank urges further investigation of this irregularity, as well as more general research on cataracts among VDT users.
- The matter of reproductive effects is "unsettled." The reproductive histories of men as well as women were studied and more birth defects were found among male users' offspring than among those of females. Further investigation of possible spermatogenesis due to VDT use is recommended.
- There was no noticeable change in sexual activity, but VDT operators commented more than non-users on being irritable, having trouble sleeping and experiencing difficulty waking up. In addition, non-users reported having more energy.

Frank acknowledged "some methodological problems" with the study but defended its scientific validity. He said he now has "one of the largest bodies" of questionnaire data available.

Approximately 3,000 survey questionnaires were distributed at six sites (St. Louis, Memphis, Vancouver, Toronto, Honolulu and New York) to reporters, editors, advertising staff members and clerical employees. A total of 1,109 responses were received, of which 1,047 were usable. Nearly three-fourths of the completed questionnaires came from VDT users, with a nearly equal number of men and women respondents. A higher pecentage of men used terminals.

Additional data from ophthalmological examinations of selected survey participants is scheduled for release next spring.

When the study was announced in March 1981, Dr. Frank was affiliated with the Mount Sinai School of Medicine in New York. The study was completed shortly before he left Mount Sinai to become Chairman of the Department of Preventive Medicine and Environmental Health at the University of Kentucky College of Medicine at Lexington.

The oversight and investigation subcommitee of the House Committee on Science and Technology, which in 1981 held the only other congressional hearing on VDTs, is not planning any immediate action (see *MWN*, June 1981). A subcommittee spokesman told *Microwave News* that chairman Albert Gore, Jr. is waiting for the outcome of a planned NIOSH epidemiological study of pregnant VDT operators, for which a study population is being sought (see *MWN*, July/August 1983).

Single copies of the report, *Effects on Health Following Occupational Exposure to Video Display Terminals*, can be obtained from David Eisen at the Newspaper Guild, 1125 15th Street, NW, Washington, DC 20005, (202) 296-2990.

Submillimeter E-Field Probe

Professor Ted Batchman of the University of Virginia has built an electric field probe which is less than one millimeter wide. The new probe is two or three times smaller than currently available models and, when fully operational, will be implantable in living tissue. In addition to applications in biological effects studies, Batchman hopes it will be used for electromagnetic compatibility measurements.

The probe, developed under a grant from the National Science Foundation (NSF), still needs some refinements. In

a telephone interview from his office in Charlottesville, Batchman said that he began with a glass substrate for the probe, but is now using mylar, a flexible nylon material, to make it less bulky.

According to Batchman, the probe can detect a minimum signal of less than 10 V/m. The calculated sensitivity is 4.5 V/m, but he believes it is actually about 1 V/m. According to theoretical calculations, the instrument's frequency range is 13 MHz to 77 GHz. Batchman hopes to have a three-axis probe, with an external diameter of about one millimeter, by early next year.

Batchman's NSF grant will not be renewed when it expires in December, and he is considering setting up a joint venture with a private company to complete the development of the probe. A group in Ottawa, Canada, has expressed an interest in working with him as well. Batchman said his optimism about securing continued financing "varies from day to day."

The Food and Drug Administration (FDA) would also like to see the probe refined. Howard Bassen at FDA's National Center for Devices and Radiological Health said that his agency is seeking interested parties to finance the completion of the probe.

A description of the probe appears in the September issue of *IEEE Transactions on Microwave Theory and Techniques*. Bassen and Glenn Smith of Georgia Institute of Technology, both of whom assisted Batchman in his work, have published "Electric Field Probes —A Review" in the September *IEEE Transactions on Antennas and Propagation*.

NBS RFI Tests on Breath Analyzers

Breath analyzers are a reliable way to check driver sobriety, according to the National Bureau of Standards (NBS) and the National Highway Traffic Safety Administration (NHTSA). Although bureau tests have demonstrated that some of the devices are susceptible to radiofrequency interference (RFI), both organizations have concluded that proper operating procedures can eliminate the risk of interference-induced errors in the measurement of alcohol concentration.

This assurance, published in a May 1983 report, is good news for law enforcment officials who use analyzer readings as evidence in court. NHTSA has advised state and local jurisdictions that they can ensure the legal admissibility of these readings by setting up programs for periodic RFI testing.

Last year several state police departments reported that their analyzers were affected by walkie-talkie and patrol car radio transmissions. The accuracy of one unit, Smith and Wesson's widely used Breathalyzer, was subsequently challenged in a suit brought in Minnesota (Heeden v. Dirkzwager, Ramsey County Second Judicial Court, 1982). Thanks to the state's RFI testing program, the reliability of the Breathalyzer readings was upheld.

Testing programs run in nine states late last year indicated that interference is in fact very rare. Following instructions and precautionary warnings distributed by NHTSA in January 1983, less than one percent of the units checked by the states were susceptible to RFI in the working environment.

NHTSA's recommendations were adapted from test protocols developed by Smith and Wesson (see *MWN*, March 1983) and by the Minnesota Bureau of Criminal Apprehension.

According to the report prepared by the bureau's Law Enforcement Standards Laboratory and released by NHTSA, nine out of sixteen units tested by NBS were affected by a 10 V/m field at one or more frequencies. Only three of the nine units registered more than a ± 10 percent change in readings when placed in a field, however. The bureau's Colorado lab exposed analyzers to four frequencies (46, 160, 460 and 850 MHz) used by law enforcement agencies. The 10 V/m field strength used approximates the environmental levels one meter from a 5-watt walkie-talkie or 10 meters from a 100-watt mobile radio. (NBS warns that its data cannot be extrapolated to other frequencies, field strengths, multiple frequency fields or other units of the same models.)

Commenting on the RFI controversy, Gerald Klein of Smith and Wesson said NBS and state tests indicate that the chance of interference in the field is extremely slight. According to Klein, the company's test procedures, which were released before the NBS report, can eliminate just about all risks of RFI.

Since problems were first reported two years ago, Smith and Wesson has retrofitted its Model 1000 Breathalyzer with a new electronic circuit to reduce possible interference. The Model 900 is not susceptible to RFI, but Klein said more caution is advisable when operating the 900A.

Smith and Wesson is not the only company to respond to user fears about RFI. Federal Signal Corp., for example, has advertised that its Intoxilyzer models produce "reliable, court-accepted evidence that RFI can't distort under normal operating conditions."

The 33-page NHTSA technical report, *Limited Electromagnetic Interference Testing of Evidential Breath Testers*, May 1983, DOT HS-806-400, is available from the National Technical Information Service, Springfield, VA 22161.

State RF/MW Standards Planned in New Jersey and Connecticut

Officials in New Jersey and Connecticut expect to propose general population exposure standards for radiofrequency and microwave (RF/MW) radiation next year. If the measures are approved, the states will join Massachusetts and several local jurisdictions which have already imposed exposure limits.

Last month, New Jersey's Commission on Radiation Protection recommended that the state formally adopt the new American National Standards Institute's (ANSI) guidelines. At about the same time, Connecticut legislators held a hear-

ing to weigh the merits of ANSI's standard against Massachusetts', which is five times more stringent (see *MWN*, September 1982 and September 1983.) For the most strictly regulated frequencies, 30-300 MHz, the ANSI limit is 1 mW/cm^2 while the Massachussets limit is 200 uW/cm^2.

According to Jim Ross of the NJ Department of Environmental Protection (DEP), the state currently uses ANSI as its benchmark for evaluating RF/MW hazards and has found no public exposures anywhere near 1 mW/cm^2. A proposal to adopt ANSI and a schedule for public hearings are expected to appear in the state's *Register* within the next six months. (It would not apply to occupational exposures.)

The state standard will be replaced by federal limits as soon as they are set. In explaining the need for interim action, Ross echoed other officials in New Jersey and Connecticut who expressed disappointment over the pace of federal standards development.

In Connecticut, State Representative Moira Lyons is leading the Environment Committee's drive to propose a standard during the 1984 legislative session. Lyons is chairwoman of a special task force studying RF/MW hazards. As a first step toward developing a standard, the group held an invitational hearing on October 20 at which representatives from the Connecticut Citizen Action Group, Northeast Utilities, Raytheon, Southern New England Telephone and the Veterans Administration Medical Center testified.

The Connecticut task force is now trying to schedule a December meeting with representatives from Massachusetts' Radiation Control Program and the National Institute for Occupational Safety and Health before submitting its recommendations to the Environment Committee.

It is uncertain at this point what type of standard will emerge from the committee. After the October meeting, however, Lyons said she believes the broadcast and cable industry could live with limits well below the ANSI guidelines.

CONFERENCES

December 8-9: ***Radiation and Energy: Confronting the Challenges of the Eighties – Law, Regulation, Risk, Liability, Litigation and Compensation,*** New York, NY. Contact: James Lawrence, Lloyd's of London Press, 817 Broadway, New York, NY 10003, (212) 673-4700.

December 12-17: ***8th Annual IEEE International Conference on Infrared and Millimeter Waves,*** Carillon Hotel, Miami Beach, FL. Contact: Dr. K.J. Button, National Magnet Laboratory, Building NW-14, MIT, Cambridge, MA 02139, (617) 253-5561.

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January 11-14: ***National Radio Science Meeting,*** University of Colorado, Boulder. Contact: S.W. Maley, Dept. of Electrical Engineering, University of Colorado, Boulder, CO, 80309, (303) 492-7004.

January 16-20: ***Microwave Signatures in Remote Sensing,*** URSI Commission F Specialist Meeting, Toulouse, France. Contact: Dr. Richard Moore, Remote Sensing Laboratory, University of Kansas Center for Research, 2291 Irving Hill Drive, Lawrence, KS 66045, (913) 864-4836.

January 17-19: ***Instrumentation & Measurement Society Technology Conference (IMTC) 1984,*** Aboard the Queen Mary, Long Beach, CA. Contact: Robert Myers, 1700 Westwood Blvd., Suite 101, Los Angeles, CA 90024, (213) 475-4571.

January 27-29: ***Symposium on NMR Imaging,*** Fontainebleau Hotel, Miami Beach, FL. Contact: American College of Radiology, 6900 Wisconsin Ave., Chevy Chase, MD 20815, (301) 654-6900.

February 6-8: ***NIH Consensus Development Conference on Use of Diagnostic Ultrasound Imaging in Pregnancy,*** National Institutes of Health, Bethesda, MD. Contact: Michaela Richardson, NIHCD, Bldg. 31, Room 2A32, 9000 Rockville Pike, Bethesda, MD 20205, (301) 496-5133.

February 23-25: ***Biological Effects and Therapeutic Applications of ELF Electromagnetic Fields,*** Venice, Italy. Contact: Dr. Luigi Zecca, Association for Biomedical Applications of Electromagnetism, Via Gentilino 9/a, 20136 Milan, Italy, (02) 8321655.

March 13-14: ***1984 National Radar Conference: Radar Technology for the 80's,*** Atlanta, GA. Contact: Dr. Edward Reedy, Georgia Institute of Technology, Engineering Experiment Station, Radar & Instrumentation Lab, Atlanta, GA 30332 (404) 424-9621.

March 23: ***Microwave and Millimeter Wave Solid State Devices and Circuits,*** RCA Labs, Princeton, NJ. Contact: Dr. Walter Slusark, RCA Labs, 201 Washington Rd., Princeton, NJ 08540, (609) 734-2946.

April 2-5: ***3rd Annual Test & Measurement World Expo,*** Brooks Hall, San Francisco, CA. Contact: Meg Bowen, 215 Brighton Ave., Boston, MA 02134. (617) 254-1445.

April 4-5: ***20th Annual Meeting of the National Council on Radiation Protection and Measurements,*** Washington, DC. Contact: NCRP, Suite 1016, 7910 Woodmont Ave., Bethesda, MD 20814, (301) 657-2652.

April 14-19: ***19th Annual Association for the Advancement of Medical Instrumentation Meeting and Exhibit,*** Washington Hilton, Washington, DC. Contact: AAMI, 1901 North Fort Myer Drive, Suite 602, Arlington, VA 22209, (703) 525-4890.

April 24-26: ***IEEE 1984 National Symposium on Electromagnetic Compatibility,*** Hyatt Regency Hotel, San Antonio, TX. Contact: William McGinnis, Southwest Research Institute, PO Drawer 28510, San Antonio, TX 78284, (512) 684-5111, ext. 2721.

April 30-May 3: ***5th Annual Meeting of the Canadian Radiation Protection Association,*** Banff, Alberta. Contact: Stuart Hunt, C-7 Civil Electrical Engineering Bldg., University of Alberta, Edmonton, Alberta T6G 2G7, Canada.

May 7-11: ***Nuclear Magnetic Resonance 1984: National Symposium,*** Hyatt Regency Grand Cypress Resort, Orlando, FL. Contact: Ms. Norine Karwel, Educational Symposia, PO Box 17241, Tampa, FL 33682, (813) 879-8765.

May 7-12: ***6th International Radiation Protection Association (IRPA) Congress,*** International Congress Center, Berlin, West Germany. Contact: R. Neider, Bundesanstalt fur Materialpurfung (BAM), Unter den Eichen 87, D-1000 Berlin 45, West Germany.

May 30-June 1: ***IEEE MTT-S International Microwave Symposium,*** San Francisco, CA. Contact: Dr. Ferdo Ivanek, Harris Corp., Farinon Division, 1691 Bayport Avenue, San Carlos, CA 94070, (415) 594-3529. The ***1984 IEEE Microwave and Millimeter Wave Monolithic Circuits Symposium*** will be held in San Francisco May 29-30 in conjunction with the MTT-S meeting.

June 3-7: ***29th Annual Meeting of the Health Physics Society,*** Hyatt Regency, New Orleans, LA. Contact: Richard Burk, Jr., HPS, 4720 Montgomery Lane, Suite 506, Bethesda, MD 20814, (301) 654-3080.

UPDATES

BIOLOGICAL EFFECTS

Thermal v. Non-Thermal (again)... The argument over whether there are non-thermal effects of RF/MW radiation continues. The latest round involves the World Health Organization's (WHO) *Environmental Health Criteria 16: Radiofrequency and Microwaves* (see *MWN*, March 1982) and a review by Professor Sol Michaelson which criticized WHO's "unqualified acceptance of postulated non-thermal bioeffects" (see *MWN*, December 1982). Four members of the WHO panel that prepared the report challenge Michaelson's critique as being "seriously biased by his commitment to the thermal mechanism of microwave-tissue interaction." Charges and countercharges appear in the August 1983 issue of *Radiation Research*. Noting that it has been four years since the document was written, the panel members state that today "a stronger case might be made for the significance and existence of non-thermal effects." Michaelson replies that "I have no commitment to any concept except scientific objectivity...I am not *committed* to thermal interactions" (emphasis Michaelson's). Another example from the exchange: The WHO panelists cite the transactions of 1981 and 1982 Biological Repair and Growth Society (BRAGS) meetings as indications that non-thermal effects exist. Michaelson answers that the transactions are irrelevant....As the dispute drags on, experimental evidence supporting non-thermal effects accumulates. Writing in the September 26 *Physical Review Letters*, Drs. W. Grundler and F. Keilman report that they have confirmed their earlier findings, which indicated "non-thermal resonant action of millimeter microwaves on the growth of yeast cultures." Their statistical analysis shows there is a "negligible probability" that the observed response, with peaks at 41.697 and 41.782 GHz, could be frequency-independent. The West German scientists conclude: "Our result enhances the weight of reports on other systems and poses the question of generality of this sensitivity in biology. Uncovering its origin will provide a fascinating interdisciplinary task."...There is more supporting data from Spain...

Delgado Varies Pulse Shape... Last March we reported that Dr. Jose M.R. Delgado's research group in Madrid, Spain, had found that extremely weak, 1.2-120 milligauss, pulsed magnetic fields can have a "consistent and powerful" effect on the development of chicken embryos. In a follow-up paper to be published soon in the *Journal of Anatomy*, the group looks at the influence of the shape of the pulse on chick embryos during their first 48 hours of development. The researchers used four different pulses, with varying rise and fall times, at approximately the same field intensities as in the original experiments. Among their findings: "Exposure to electromagnetic fields with a pulse rise time of 100 microseconds produced teratogenic changes when intensities of [10 and 139 milligauss] were used but not with lower or higher intensities, demonstrating a 'window' effect and ruling out the possible influence of a rise in internal embryonic temperature....When embryos were exposed to intensities of [4 and 10 milligauss] with 2.0 and 42 microsecond pulse rise times, teratogenic effects were greater and alterations involved all developing systems. The most powerful effects were obtained with [10 milligauss] and 42 microsecond rise time." They conclude that the pulse shape may be the "decisive parameter determining strong, slight or no modification of embryonic development," and that "mechanisms of action of electromagnetic fields are still unclear, but induced alterations in extracellular glycosaminoglycans could be a causal factor in the observed malformations."

COMMUNICATIONS

Siting Problems in New Jersey... Vernon, NJ, has apparently tempered its view of potential RF hazards. Since last year, a community group worried about RF health effects has blocked RCA Americom's plans for a new point-to-point tower at its Vernon satcom station (see *MWN*, November 1982 and March 1983). Although RCA still doesn't have official approval for its low power antenna, on October 20 the town zoning board granted the American Satellite Company a variance to add a 13-meter dish to its Vernon station. RCA now plans to submit a new application for upgrading its facilities. Amsat brought in consultants on RF safety, and after six hearings the board unanimously approved its request. Three conditions were attached to the variance, however: 1) Power densities at the edge of Amsat's property cannot exceed 1 uW/cm^2; 2) RF levels at the perimeter of the station must be measured annually for three years; 3) Amsat must install mechanical locks on the antenna to ensure that its elevation angle is always greater than 12.5 degrees. Joan Griffin, an attorney with the Rockville, MD, company, said that construction has already begun. Meanwhile, the NJ Department of Health is finishing up its study of birth defect rates in Vernon during the years following construction of the satcom stations in the 1970s. The investigation began early this year at the urging of Citizens Against the Tower, a community group opposing any additional RF/MW sources in the area (see *MWN*, December 1982).

Cellular Mobile Phone Service Begins... Ameritech Mobile Communications Inc. became the first company to offer cellular mobile phone service with the start-up of its Chicago-area system last month. Similar systems will open in other major cities soon, each with the capacity to service thousands of car phones rather than the hundreds now in use. Through a network of low-power transmitters, cellular technology allows the same frequency to be used simultaneously by drivers in different areas. Though this technology provides an efficient way to utilize the limited spectrum available for mobile communications, the FCC has warned there may be some tradeoffs. In its August 1983 report, *Future Private Land Mobile Telecommunications Requirements*, the commission's Private Radio Bureau states that call quality may suffer from the low signal strengths of network transmitters and that co-channel and adjacent channel interference may limit the capacity of cellular systems. For the present, however, any big city resident with $3,000 for a mobile phone will be able to make high quality calls

while on the road. A limited number of copies of the FCC's report are available from its Office of Public Affairs, Room 207, 1919 M Street, NW, Washington, DC 20554, (202) 254-7674.

COMPATIBILTY & INTERFERENCE

FCC Survey of RF Device Compliance... The FCC has found a small improvement in the number of RF devices that meet its RFI regulations. In the last six months, the agency has sent its engineers to 144 retail stores in more than 50 cities across the country to inspect computers, walkie-talkies, cordless phones, TVs, video games and other RF-emitting equipment. The survey of 1,746 devices found that 31 percent of computer equipment and 18 percent of coin-operated video games were improperly labeled and thus in violation of commission rules. Nine percent of the devices had no label at all, indicating they did not meet FCC emission limits. The FCC considers these results "disturbing," but is looking at the bright side because they represent a four percent improvement over last year's survey results. Joseph Casey, chief of the FCC Field Operations Bureau's Inspections and Investigations Branch, promises to continue his efforts to force compliance, levying "substantial" fines when necessary.

Green Light for Radio Marti... Congress has approved and the President has signed the "Radio Broadcasting to Cuba Act." It authorizes the creation of Radio Marti within the US Information Agency's Voice of America (VOA), to broadcast "accurate, objective and comprehensive news" to Cuba. Reagan signed S.602 into Public Law 98-111 on October 4. The compromise measure, which emerged after nearly two years of controversy, requires Radio Marti to use VOA's AM frequencies, primarily 1180 kHz. Will Cuba respond by trying to jam Radio Marti, as broadcasters have long feared? If so, the law allows the new station to lease time from other AM stations to broadcast over their frequencies. Also, the government can compensate station owners for losses due to interference from Cuba. For more information, see Senate Report No. 98-156, June 21, 1983, available from the Senate Document Room, Washington, DC 20510.

Resources...NBS has published *A Method to Quantify the Radiation Characteristics of an Unknown Interference Source*, (TN 1059), which describes the theory and experimental details for making measurements with a transverse electromagnetic (TEM) cell. A copy is available for $4.75, prepaid, from the US Government Printing Office, Washington, DC 20402. Order No. 003-003-02441-4....The Radio Technical Commission for Aeronautics (RTCA) Special Committee No. SC-148 on "Airborne Radio Communications Equipment Operating Within the Radiofrequency Range 117.975-137.000 MHz" plans to discuss ways of mitigating FM interference to airborne communications devices at its October 26-28 meeting....When power lines are built near AM radio broadcast antennas, large currents may be induced on the line. These can re-radiate a field and cause a major change in the antenna's radiation pattern. A group of Canadian reseachers explore ways of minimizing these interactions by adding "detuners" to the power line to reduce the re-radiated field. They detail such corrective measures in a paper in the August issue of *IEEE Transactions on Electromagnetic Compatibility*....Tecknit has published an *EMI Shielding Design Guide*, which is available for $10.00 from the company at 129 Dermody St., Cranford, NJ 07016, (201) 272-5500.

INTERNATIONAL

Australian Union Group... The Occupational Health and Safety Unit of the Australian Council of Trade Unions and the Victorian Trades Hall Council (ACTU/VTHC) has issued *Guidelines on Health Hazards of Electromagnetic Radiation*, a consultative document (Health and Safety Bulletin No. 31) with recommended exposure standards for ELF, RF/MW, IR, visible, UV and laser radiation. The unit finds that, "the claim that biological effects of EMR are exerted through heating mechanisms alone is without foundation, and therefore any standards based on these thermal effects alone offer no protection against cancer, genetic effects or cataracts of the eye." It advocates a preventive approach to radiation hazards and endorses a policy that exposures "should be reduced to the lowest levels technically achievable." Specifically, the unit recommends maximum exposures of 500 V/m for 0-100 Hz and 100 uW/cm^2 for 100 Hz-300 GHz. For IR and visible radiation the limits are 1 mW/cm^2. In addition, it advocates an emission standard of 1 mW/cm^2 for all new radiation emitting equipment (measured at 5 cm). The document is now circulating among affiliated unions for comment. According to the unit's research officer, Dr. John Matthews, a formal ACTU/VTHC policy will be adopted within six months to "guide unions in their negotiations with employers to reduce workers' exposure to EMR." (In August 1982, the Standards Association of Australia (SAA) proposed occupational exposure standards for RF/MW radiation (30 kHz-300 GHz) identical to those adopted by ANSI in 1982 and suggested limits for the general public a factor of ten lower than ANSI's. ACTU criticized the SAA proposal in comments filed this spring.) The ACTU-VTHC unit went through a similar consultative process with its policy for *Screen-Based Equipment*. A proposal for VDTs and related equipment was issued in May 1982 and a final policy statement was released in March 1983 (Health and Safety Bulletin No. 26).

New Association and Institute... The *Association for Biomedical Applications of Electromagnetism* has been formed in Milan, Italy, to promote scientific research on the bioeffects and medical applications of EM fields. ABAEM is planning its first congress, *Biological Effects and Therapeutic Applications of ELF Electromagnetic Fields*, to be held in Venice, February 23-25, 1984. For further information, contact the association's vice-president, Dr. Luigi

Zecca, Via Gentilino 9/a, 20136 Milan, Italy....Dr. Richard Bentall has set up the *Institute of BioElectrical Research* in Peebleshire, south of Edinburgh, Scotland. Bentall said in an interview that the non-profit institute will investigate the effects of EM fields on *all* living systems. For instance, he is interested in horticultural research: the effects on barley and other food crops. Bentall is also concentrating on soft tissue medical applications, such as the healing of wounds and burns. Contact: Bentall, Director, IBER, Romanno House Farm, Romannobridge, West Linton, Peebleshire EH46 7BY, United Kingdom.

MILITARY SYSTEMS

Project ELF... The last witness, Dr. Robert Becker, testified at the Project ELF trial in Wisconsin on October 19 and the attorneys for the state and the navy are now completing their final written arguments. A decision on whether the navy will have to prepare a new environmental impact statement (EIS) will come after November 21 when the Wisconsin Attorney General files his last brief. Some observers expect the decision to be handed down in January. On October 19, Judge Barbara Crabb denied a preliminary injunction, which would have stopped the navy from beginning construction on the ELF antenna until she issued a ruling. The judge found that the state would not be irreparably harmed if the work gets under way, but she warned the navy would be building at its own risk....The navy has released its environmental impact assessment (EIA) for construction of the ELF's Michigan facility in Dickinson and Marquette Counties. It deals primarily with the installation of the antenna lines and not their operation because the navy argues that it has continuously reviewed new scientific information on ELF propagation since the release of its 1977 EIS, and has concluded that "there is no credible evidence of adverse effect to human health or the environment." A limited number of copies of the EIA are available from Capt. R.L. Koontz, PME 110E, Naval Electronic Systems Command, Washington, DC 20363, (202) 692-8871.

MM Waves Setback... The US Air Force has cancelled its WASP millimeter wave, air-to-ground guided missile program. The move, requested by the Senate Armed Services Committee, is seen as a setback for the application of millimeter waves. As one expert put it, the market for millimeter wave technology is small and any such cancellation will hurt its development. An air force spokesman said that the Wide Area Anti-Armor Munitions (WAAM) program, designed to improve the ability of aircraft to destroy tanks, will move forward. The WASP missile was only one of a number of WAAM concepts. The WASP was being developed by Hughes Aircraft Co.'s Missile Systems Group, which is also working on a smaller missile with millimeter wave radar for the army's multiple lauch rocket system. No other air force weapon system using millimeter waves is as advanced as WASP, but *Aviation Week* reported on October 3 that a mock-up of the Tactical Avionics Low-Level Navigation and Strike (TALONS) millimeter wave radar was shown at the recent Air Force Association Convention. This project is being developed by United Technologies' Norden System for both the air force and the army.

POWER LINES

Epidemiological Studies Chosen by NY... The New York State Power Lines Project has signed contracts for two epidemiological studies on the relationship between alternating magnetic fields (AMFs) and cancer rates (see *MWN*, September 1983). Dr. David Savitz of the University of Colorado in Denver will investigate the incidence of childhood cancer and its possible association with AMFs in a project modeled after Dr. Nancy Wertheimer's work. Dr. Lowell Sever of Battelle Pacific Northwest Labs in Richland, WA, will investigate adult myelocytic leukemia and AMFs. Approximately $700,000 is budgeted for the studies. Copies of the final study proposals are available for 25 cents per page from Michael Rampolla, Power Lines Project Administrator, New York State Department of Health, Center for Laboratories and Research, Empire State Plaza, Albany, NY 12201, (518) 474-7888.

VDTs

Ohio Legislation...A bill that would set health and safety standards for VDTs has been introduced in the Ohio General Assembly. This brings to five the number of states with VDT legislation pending (New York, Oregon, Massachusetts, Illinois and Ohio). Maine and Connecticut passed bills earlier this year (see *MWN*, June 1983). The Ohio bill (No. 552), introduced October 14 by State Representative Barbara Pringle, would require adjustable, flexible work stations, measures to reduce glare, regular thorough eye examinations for operators and metal shielding of terminals to block radiation emissions. Also included are regular rest breaks, daily limits on the time spent operating a VDT, the right to non-VDT work during pregnancy and a prohibition against using terminals to monitor productivity or measure work performance of individual operators. Pringle says she is most concerned about reported pregnancy problems. The legislation, which would affect public and private employers in the state, is not likely to be acted on this year. Copies of the legislation are available from Rep. Pringle, Ohio House of Representatives, Columbus, OH 43215, (614) 466-6107.

International... The Canadian Labor Relations Board (CLRB) has rejected the request of a pregnant VDT operator for alternative work. Canadian union representatives are concerned that the decision could set a precedent, reversing a trend that started when employees of Bell Canada and members of the Ontario Public Service Employees Union (OPSEU) won the right to non-VDT work during pregnancy (see *MWN*, April 1981 and September 1982, respectively). Jean Sibley, an employee of Atomic Energy of Canada (AEC), claimed that VDT use placed her in "imminent danger" during her pregnancy, qualifying her for protection

(continued on p.11)

FROM THE FIELD

Last June, Dr. Robert O. Becker wrote to the Food and Drug Administration (FDA) to express his apprehension over the growing use of medical devices that apply direct currents (DCs) and pulsed electromagnetic fields (PEMFs) to stimulate bone growth. Reprinted below is an edited version of Becker's letter. Until his retirement in 1981, Becker was a research professor at the SUNY Upstate Medical Center in Syracuse, NY, and chief of orthopedic surgery at the Syracuse VA Hospital. He is the editor of Mechanisms of Growth Control *(1981), and the author, with Dr. Andrew Marino, of* Electromagnetism and Life *(1982).*

When contacted by Microwave News, *Dr. Alan Andersen, the deputy director of the Office of Standards and Regulations at FDA's National Center for Devices and Radiological Health, said that the agency was preparing a response to Becker.* Microwave News *will publish FDA's reply in a future issue.*

Meanwhile, we invite all interested parties to comment on Becker's letter.

Bone has been the one tissue most extensively studied from the point of view of its electrical properties and its growth response to electromagnetic fields. The response of bone to mechanical stress (Wolff's Law) has been ascribed to its innate piezoelectric properties [1,2], and the healing of fractures has been related to electrical properties common to regenerative growth in general [3,4].

When bone growth devices were first approved, it was assumed that, because of its unique properties, bone would be the only tissue responding to such electrical parameters.

The DC devices (eg, Zimmer's and Telectronics'), which use cathodes implanted at the treatment site, were intended to duplicate the naturally occurring electrical potentials observed during fracture healing. It was postulated that they would stimulate the cell populations required to form new bone. However, neither the responsible cell lines (periosteal, endosteal or marrow) nor the cellular mechanisms involved were identified with precision. Literature reviews [5,6] indicate that the DC devices produce de-differentiation of some marrow with subsequent re-differentiation into bone. This is a duplication of a portion of the natural fracture healing sequence.

The PEMF devices (eg, Electrobiology's [EBI] external coil system) operate in two distinct "modes" [7] each with a highly specific field pulse and a corresponding specific induced current pulse. No claims were made for direct growth stimulation; one mode was claimed to produce increased fibrogenesis and the other to produce efflux of calcium ions. Acting in concert they purport to form new bone [8]. The magnetic field is considered to be free of biological activity [9]. Recent evidence indicates that both modes have identical effects [10].

Both DC and PEMF devices expose tissue other than the target bone to the active stimuli. The Zimmer unit exposes the greatest amount by virtue of the bulk conduction of the current between the implanted cathode and the remote surface anode. The EBI device generates a magnetic field that penetrates all tissue between the coils and, by virtue of the fringing field, a considerably greater bulk although at diminished strength. The Telectronics device exposes the least amount of tissue because the implanted electrodes are closer together, although the current density is considerably greater than with the other devices.

When the FDA approved these devices, there were no studies on the effects of electrical currents or magnetic fields on embryonic growth and development or malignant growth. Evidence obtained over the past few years indicates that both electrical currents and magnetic fields have direct cellular effects which are, to a certain extent, dependent upon the type of cells exposed and their functional state. Neither effect is limited to bone or bone forming cells.

Direct electrical currents at levels obtainable within the bulk transmission area of the clinical devices (360 nA) increase the mitotic rate of human fibrosarcoma cells (HT 1080) *in vitro*, by a minimum of 300 percent [11].

The action of time-varying magnetic fields in general, including the specific pulses of the EBI device as well as simple ELF and VLF sine waves, can now be ascribed to a stimulation of mitotic activity [12]. The effect can be produced by magnetic fields as low as the Earth's (0.5 gauss) [13]. The magnetic field itself and not the induced current has been identified as the responsible agent [13,14]. There is evidence that RF frequencies modulated at ELF frequencies have identical effects [15].

Time-varying magnetic fields of similarly low strengths have been shown to induce severe embryological abnormalities in chick embryos [16]. This report has not yet been substantiated in detail, but another paper has indicated the production of such abnormalities in chick embryos exposed to PEMFs and incubated at a slightly higher than normal temperature or subjected to relatively minor surgical trauma [17]. An enhancement of mitotic activity of human leukemia cells by time-varying magnetic fields of similar strength and frequency has also been reported [18].

It should be noted that a number of retrospective epidemiological studies have indicated a higher than normal incidence of leukemias in individuals occupationally exposed to electromagnetic fields (primarily 60 Hz) [19], and a number of clusters of fetal abnormalities have been reported in female workers using VDTs [20].

It is evident that the exact mechanisms of action of DCs and PEMFs are different from originally proposed and require further evaluation. It is also evident that both modalities may have the capacity to enhance malignant growth. While it has not been demonstrated that either modality has a direct carcinogenic activity, the enhancement effect upon malignant cells could be considered to "tip the scales" in favor of such processes over the normal immunological resistance factors, thus encouraging the growth of small areas of malignant or pre-malignant transformation that otherwise would be destroyed.

A number of reports indicate a prolongation of survival times in animals with implanted tumors and treated with PEMFs [21]. This effect, however, is ascribable to the well established activation of the stress response system by whole-body exposure to time-varying magnetic fields [22]. In fact the most recent study states that such activation of the immune system is the mechanism responsible for the prolongation of survival [23].

I am aware that every device evaluation must involve a risk-benefit analysis. The ubiquitous presence of time-varying ELF magnetic fields in the environment is a necessary concomitant of our electrical power transmission systems, which are obviously of great social and economic importance. Such fields may be associated with a number of deleterious health effects and any risk-benefit analysis must await adequate epidemiological studies. At the present time, the use of time-varying magnetic fields in clinical therapy has no such constraints since there are other more conservative treatments available for the same conditions.

The therapeutic use of DCs and PEMFs as well as other electrically derived techniques holds great promise for many areas of medical practice. The ability to stimulate and control growth processes and to influence neuronal mechanisms has applications far beyond the stimulation of bone growth. The entire field must be thoroughly explored, mechanisms of action identified and side effects determined prior to widespread use. Unrestricted use of devices presently approved, or pending approval, could well result in an unfortunate incident thus delaying the ultimate application of the entire technology.

I urge that a moratorium be placed upon all clinical applications until adequate investigation has been completed.

Robert O. Becker, MD
Star Route, Lowville, NY 13367

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UPDATES *(continued from p. 9)*

under the Canada Labor Code and permitting her to demand work away from a terminal. Her request for non-VDT work was denied by a federal Labor Canada safety officer, leading her to appeal to the CLRB. The board concluded that there is no "hard evidence" of pregnancy risks associated with VDTs and cited several studies which state that no risks exist. For this reason, it would be "unreasonable to so stretch" the Canada Labor Code to cover Sibley's request, the board ruled. Working at AEC's Glace Bay, Nova Scotia facility, Sibley was given a lead apron by AEC to wear while her appeal was pending despite prior protests by the company that there was no need for her to wear one. Copies of the board ruling (Decision No. 431, Board file 950-19) can be ordered from the Canadian Labor Relations Board, Ottawa, Ontario, Canada, K1A 0X8, (613) 996-9466....Some Australian journalists will now be entitled to take regular, 10-minute rest breaks from their VDTs after two hours' work as a result of recent arbitration, the US Newspaper Guild reports. The federal Australian Conciliation Commission ruled that 2,500 journalists at metropolitan daily newspapers can take paid breaks from their terminals as of September 1, but employers may assign other work during these periods. In emergencies, the commission said, terminal users can work no longer than two-and-a-half hours without a rest period.

Resources...A report on Swedish union responses to VDT and other work environment issues has been prepared by Dr. Olov Ostberg, a visiting scientist at NIOSH in Cincinnati. *Work Environment Issues of Swedish Office Workers: A Union Perspective,* will be included in a book scheduled for 1984 publication. Ostberg credits Swedish unions, notably TCO, the Central Organization of Salaried Employees, with primary credit for the Swedish Work Environment Act of 1977 and a new federal ordinance that will require ergonomically correct viewing conditions and individualized visual aids for workers beginning January 1. Ostberg emphasizes ergonomics as the "predominant" cause of all occupational diseases. His paper will appear as a chapter in *Human Aspects in Office Automation,* to be published by Elsevier (Amsterdam)....The VDT telephone hotline operated by 9 to 5, National Association of Working Women, closed November 1 after receiving more than 5,000 calls (see *MWN,* June 1983). The Cleveland 9 to 5 affiliate has announced that it will establish a local hotline to provide information and resources....Local 925 of the Service Employees International Union (SEIU, AFL-CIO) has published model language for unions interested in including VDT provisions in their contracts. Sample wordings are provided in nine areas including work breaks, workstation design, employer-paid eye examinations and long-term study of the health effects of VDTs. Requests for copies should be directed to District 925, SEIU, AFL-CIO, 2020 K Street, NW, Washington, DC 20006, (202) 452-8750.

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OSHA *(continued from p.1)*

Auchter's determination was reached informally, according to a series of interviews with agency officials, all of whom asked that their names not be used. RF/MW radiation was not deemed important enough to warrant further attention. Other options, such as adopting the 1982 American National Standards Institute (ANSI) RF/MW exposure limits, were considered but rejected.

Voluntary Standard To Remain

OSHA's current 10 mW/cm^2 health standard is voluntary and has been ruled unenforceable by the courts (see *MWN*, April 1982). The agency used to have another option: enforcing standards set by other organizations, such as ANSI, under the Occupational Safety and Health Act's general duty clause, Section 5(a)(1), which requires that every work place be free of recognized hazards. But in March 1982, Auchter ruled that OSHA inspectors cannot enforce voluntary standards under the general duty clause (see *MWN*, April 1982). As a result, OSHA stopped monitoring worker exposure to RF/MW radiation.

In May 1982, OSHA proposed deleting its voluntary standards, including the one for RF/MW radiation (47 *Federal Register* 23479, May 28, 1983). According to the October regulatory timetable, a final rule for these deletions is scheduled for November 1983. OSHA's Graybill said that while this deadline might still be met, the rule is more likely to appear in December.

Microwave News has learned that OSHA does not plan to delete the 10 mW/cm^2 RF/MW standard. Informed sources said that the RF/MW standard is not listed among the voluntary standards to be scrapped in the current draft of the final rules. Graybill would neither confirm nor deny this fact, but did say that OSHA rules should not be construed as final until they appear in the *Federal Register*.

If the 10 mW/cm^2 standard remains in the rules, OSHA inspectors will be barred from issuing citations for worker overexposure to non-ionizing radiation.

Joe Velasquez, the executive director of the Worker Institute for Safety and Health said that he was not surprised by this development; "It fits a pattern by the Reagan Administration to weaken worker protection."

ANPRM Never Published

At the end of last year, the OSHA staff prepared an advanced notice of proposed rule making (ANPRM) for a new RF/MW standard for review by the agency's senior management (see *MWN*, October 1982). The proposal was still under consideration as late as last spring, but it was never approved or published in the *Federal Register*.

The National Institute for Occupational Safety and Health (NIOSH) has been preparing a criteria document for RF/MW radiation since the mid-1970s. The document, which would be the basis for an OSHA standard, has suffered a series of setbacks and is still not finished. According to a NIOSH staffer, a review draft of criteria document should be completed by the end of 1983.

SHORT COURSES

December 5-6: ***EMI Workshop,*** Philadelphia, PA. Fee: $575. Contact: R&B Enterprises, 20 Clipper Road, W. Conshohocken, PA 19428, (215) 825-1960.

December 5-9: ***Microwave Circuits: Theory & Applications,*** Sunnyvale, CA. Fee: $850. Contact: Continuing Education Institute, Suite 1000, 10889 Wilshire Blvd., Los Angeles, CA 90024, (213) 824-9545 or (301) 596-0111.

December 5-9: ***EMC Design & Measurement for Control of EMI,*** Fee: $995. Contact: Don White Consultants, Inc., (DWCI), State Route 625, PO Box D, Gainesville, VA 22065, (703) 347-0030.

December 6: ***Electrostatic Discharge Control Seminar,*** Phoenix, AZ. Fee: $275. Contact: EMXX Corp., 6706 Deland Drive, Springfield, VA 22152, (703) 451-4619.

December 6: ***Hospital Electrical Safety,*** New York, NY. Fee: $180 (AAMI members), $200 (others). Contact: Association for the Advancement of Medical Instrumentation (AAMI), Suite 602, 1901 North Fort Myer Dr., Arlington, VA 22209, (703) 525-4890.

December 6-9: ***Antenna Measurement Techniques,*** Atlanta, GA. Fee: $660. Contact: Technology Service Corp. (TSC), 8555 16th St., Suite 300, Silver Spring, MD 20910, (800) 638-2628.

December 6-9: ***Radar Systems Engineering,*** Fort Walton Beach, FL. Fee: $660. Contact: TSC, see December 6 above.

December 12-16: ***Electromagnetic Interference and Control,*** Washington, DC. Fee: $875. Contact: Continuing Engineering Education, George Washington University (GWU), Washington, DC 20052, (800) 424-9773.

December 14-15: ***EMI Diagnostics and Fixes,*** Philadelphia, PA. Fee: $635. Contact: DWCI, see December 5 above. Repeated ***January 25-26:*** San Diego, CA.

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January 9-13: ***Fundamentals of Radar Cross Section,*** St. Cloud, FL. Fee: $695. Contact: Southeastern Center for Electrical Engineering Education (SCEEE), Central Florida Facility, 1101 Massachusetts Ave., St. Cloud, FL 32769, (305) 892-6146.

January 17: ***EMC: The FCC Means Business,*** San Francisco, CA. Fee: $595. Contact: Carol Clark, McGraw-Hill Seminar Center, 331 Madison Avenue, Suite 603, New York, NY 10017, (212) 687-0243. Repeated ***April 3:*** Boston, MA.

January 23-27: ***Microwave High-Power Tubes and Transmitters,*** Los Angeles, CA. Fee: $875. Contact: GWU, see December 12 above.

January 31-February 2: ***Millimeter Wave Systems & Technology,*** Atlanta, GA. Fee: NA. Contact: Dept. of Continuing Education, Georgia Institute of Technology (GIT), Atlanta, GA 30332, (404) 894-2547.

February 8-9: ***Microwave Devices & Sources,*** Atlanta, GA. Fee: NA. Contact: GIT, see January 31 above.

February 16-17: ***Grounding, Bonding & Shielding,*** San Diego, CA. Fee: $625. Contact: GWU, see December 12 above. Repeated ***April 9-10:*** Washington, DC.

February 21-24: ***Microwave Solid State Devices and Circuits,*** Los Angeles, CA. Fee: $895. Contact: UCLA Extension Short Course Program, PO Box 24901, 6266 Boelter Hall, Los Angeles, CA 90024, (213) 825-1047.

February 27-March 2: ***Spread Spectrum Systems and Interference Rejection Techniques,*** Los Angeles, CA. Fee: $895. Contact: UCLA, see February 21 above.

March 5-7: ***Planning & Implementing an NMR Imaging Facility,*** Washington, DC. Fee: $695. Contact: GWU, see December 12 above.

March 12-16: ***Radiowave Propagation for Communications Systems Design,*** Orlando, FL. Fee: $875. Contact: GWU, see December 12 above.

March 15-16: ***Lightning Protection,*** Orlando, FL. Fee: $625. Contact: GWU, see December 12 above.

March 19-23: ***Flat-Panel and CRT Technologies,*** Los Angeles, CA. Fee: $895. Contact: UCLA, see February 21 above.

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Microwave News invites contributions to *From the Field*, our occasional column featuring news and opinions from the non-ionizing radiation community. Letters from readers are also welcome.

Extremely Weak Magnetic Fields Affect Behavior

Extremely weak magnetic fields can have a profound effect on the behavior of rats, according to new experimental findings at a Navy research lab. The results have generated a great deal of excitement because the observed effects were *predicted* by a theoretical model and because the applied fields were of such low intensity.

The model assumes that biologically important ions undergo cyclotron resonances when influenced by static and oscillating magnetic fields. The results reaffirm the pivotal role played by the Earth's magnetic field in bioelectromagnetic interactions.

The new findings are the result of a collaboration between Dr. Abraham Liboff, a physicist at Oakland University in Rochester, MI, and Drs. John Thomas and John Schrot, psychologists at the Naval Medical Research Institute (NMRI) in Bethesda, MD. Using predictions from a model devised by Liboff, Thomas and Schrot found that rats exposed to 60 Hz fields of less than 100 milligauss in a static magnetic field of 270 milligauss displayed impaired timing discrimination. Thomas told *Microwave News* that the results constitute "one of the most interesting developments to come along in a long time."

Thomas is not alone in this assessment. In an October 15 site visit at NMRI for the New York State Power Lines Project, Dr. Mike Marron of

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State Power Line Actions

Several state and local governments are currently addressing power line health and safety issues. Although it is likely that only Montana will adopt power line radiation limits this year, there is a clear trend toward government intervention on behalf of a concerned public. The following status reports summarize developments in Montana, Michigan, Virginia and Texas.

Montana

The Montana Department of Natural Resources and Conservation held three hearings in October on its proposed overhaul of the state's Major Facility Siting Act rules. Proposed Rule CXIV sets a 1 kV/m limit for the electric field at the edge of a right-of-way (ROW) in residential or subdivided areas, measured one meter above the ground. Noise levels would be limited to 50 dB at the edge of the ROW. A landowner can waive these requirements, but the electric field under the line will not be permitted to exceed 7 kV/m at road crossings (see *MWN*, July/August 1983).

According to Paul Stolen in the department's Energy Division, no new technical data challenging the state's position were submitted during the hearings. He expects that the state's Board of Natural Resources will adopt the rules before Christmas. "After looking at the comments received," he said in a telephone interview, "there should be no problem making the Christmas deadline."

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the Office of Naval Research called the demonstration "stunning."

Marron went on to report that the new effect "provides strong support for the hypothesis that static magnetic fields, similar in strength to the Earth's magnetic field, can dramatically alter the response of a living organism to alternating electromagnetic fields."

In a number of interviews, researchers who had already learned of the Liboff-Thomas findings expressed similarly enthusiastic opinions.

Cyclotron Resonances

Liboff calculated the resonant frequencies of ions under conditions of cyclotron resonances for various values of a static magnetic field. According to his model, lithium ions absorb 60 Hz radiation in a static magnetic field of 270 milligauss (about half the Earth's field).

Thomas then exposed rats under these conditions and found what he called "fairly remarkable changes in behavior" for 60 Hz magnetic fields of less than 100 milligauss. Indeed, Thomas said he found statistically significant alterations in behavior for "almost immeasurable" magnetic fields.

According to Liboff, lithium ions affect the functioning of neurotransmitters, especially epinephrine (adrenaline), and therefore any changes in lithium concentrations in and around cells can translate into changes in behavior.

The effect appears to be transient. The rats exhibited the observed, altered behavioral patterns an hour after a 30-minute exposure, but returned to normal 24 hours later.

When asked about the reliability of the behavioral test, Thomas said that the timing discrimination protocol has been used to test the effects of drugs for more than 20 years and is very reliable.

Liboff and Thomas have also exposed rats to the 60 Hz field without modifying the Earth's magnetic field, to a reduced static magnetic field without the alternating magnetic field and to baseline (control) conditions. For each of these exposure conditions, they found no effects, indicating that a resonance phenomenon is present.

(A charged particle moving with an initial velocity in a magnetic field will experience a force perpendicular to the magnetic field and the line of motion. As a result, the ion will move along a circular or helical path characterized by a specific angular frequency and can absorb electromagnetic energy at that specific frequency, which is a function of the ion's charge-to-mass ratio and the magnetic flux density. That frequency is known as the cyclotron resonance frequency.)

Through or Near the Membrane

Liboff's original model assumes that ions make their way into a cell by crossing the membrane along helical structures. Thus, the ions travel in helices and, he concludes, have distinctive cyclotron resonances.

When Liboff presented his hypothesis at a NATO workshop in Erice, Italy in September, three general types of questions were raised: (1) Do such helical structures actually exist? (2) If the ions are hydrated, as some experts maintain, will the weight of the water molecules affect the crucial charge-to-mass ratio which determines the cyclotron frequency? (3) If the ions collide as they go through the membrane, how will such interactions affect the ion motion and therefore possible resonances?

While none of these questions pose insurmountable obstacles to Liboff's model, they do suggest that more research is needed if the model is to gain widespread acceptance.

Some researchers believe that you do not have to invoke helical pathways to measure cyclotron resonances. It may be that the resonances stem from the movement of ions on the surface of the membrane.

Whatever the physical mechanism, Liboff's hypothesis on the presence of cyclotron resonances yielded the precise combination of static and alternating magnetic fields that caused distinctive changes in the behavior of live animals. As Dr. Mays Swicord of the Food and Drug Administration said in an interview: "Is it a coincidence? I think there is some relationship here."

Blackman's Data

Dr. Carl Blackman of the Environmental Protection Agency invoked the concept of cyclotron resonance as a possible explanation for his experimental results on the efflux of calcium ions from brain tissue as a function of the static and alternating fields at last summer's Bioelectromagnetics Society meeting in Atlanta (see *MWN*, September 1984). At that time, he was unwilling to commit himself to this mechanism, however. Nor will he now.

At the end of October, Blackman told *Microwave News:* "Liboff's and Thomas's experimental results once again demonstrate the pivotal importance of the Earth's magnetic field, but it is still too early to bank on one mechanism to explain them. As far as I am concerned, we have a fascinating phenomenon in need of an explanation."

Equipment Limitations

Thomas ran the experiments with equipment that was designed for another project contracted by the New York State Power Lines Project. Thomas and Liboff were thus unable to change the frequency of the alternating magnetic field; they could only use a 60 Hz field with a partial ability to vary the static magnetic field.

Because of these limitations, Thomas and Liboff could not alter the Earth's magnetic field sufficiently to test whether potassium and sodium ions exhibit similar cyclotron resonances. Given the biological importance of these elements, they are natural candidates for future studies.

Meanwhile, theoreticians will be busy trying to explain how a force that is some 12 orders of magnitude smaller than natural, thermal interactions can have such profound effects on a living system.