Over-the-Horizon Radars Almost off the Scope

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

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

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

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

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

BENER Is Back

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

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

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

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

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

ELF and RF/MW Measurement Notes

Residential Surveys

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

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

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

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

EPRI Dosimetry Workshop

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

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

Low-Cost ELF Meters

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

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

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

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

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

New RF/MW Meters

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

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

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

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

EMF Testers Group

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

Measurement Resources

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

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

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FROM THE FIELD

Magnetic Field Exposures Among Office Workers

To the Editor:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

SAB Subpanel Members

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

* Head of the subpanel.

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

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

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

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

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

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

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

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

White House's Allan Bromley in His Own Words

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

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

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

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

White: By the science as presented by EPA.

Bromley: That's correct.

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

Bromley: Of course.

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

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

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

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

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

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

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

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

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

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

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

EPA Funding *(continued from p.1)*

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

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

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

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

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

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

UPDATES

MEETINGS

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

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

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

PEOPLE

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

VDTs

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

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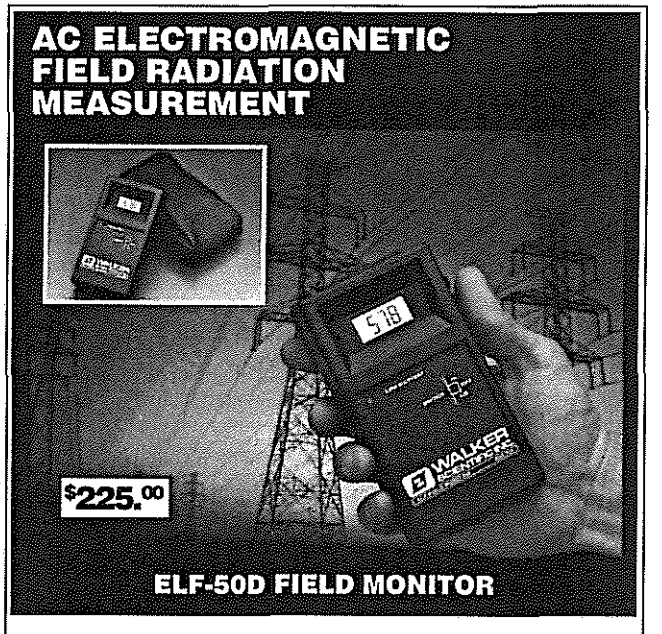
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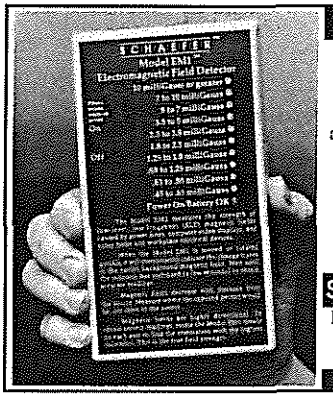
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Cellular Telephone Radiation Blamed for Brain Tumor

In the first case of its kind, NEC America Inc. and GTE Mobilnet of Tampa Inc. have been sued over allegations that the use of a cellular phone caused or promoted the development of a woman's brain tumor.

In a complaint filed April 8 in the Circuit Court for Pinellas County, FL, Susan Reynard and her family charged that, "The tumor was the result of radiation emitted by a cellular telephone [or] the course of the tumor was accelerated and aggravated by the emissions from the telephone..."

Susan Reynard used an NEC P9000 hand-held cellular phone for two years prior to being diagnosed with a malignant left parietal tumor in May of 1990, according to her husband, David Reynard. He explained that the first sign of his wife's illness came about a year before the diagnosis of cancer, when she had some loss of peripheral vision in her right eye. At that time, doctors examining a magnetic resonance imaging (MRI) scan found what they thought was a small lesion, which they took to be evidence of a mild stroke. A year later, a second MRI showed a tumor at the same location. Susan Reynard died late in May 1992.

She had "made regular and frequent use of the cellular phone," according to her attorney, John Lloyd Jr. of St. Petersburg, FL. He added that he is still examining phone company and other records to document the extent and

(continued on p.10)

Human and Cellular Studies Point to Similar Mutagenic Effects of Radar

Epidemiological and laboratory studies point to similar genetic effects from exposure to microwave radiation, according to a series of studies carried out by researchers at the University of Zagreb in Croatia.

"We found the same type of chromosomal abnormalities among workers exposed to radar radiation and in cells exposed in vitro," Dr. Vera Garaj-Vrhovac of the Laboratory for Mutagenesis at the university's Institute for Medical Research and Occupational Health told *Microwave News*.

The Croatian work is the strongest evidence to date pointing to a mutagenic effect of high frequency radiation. There have been relatively few studies of chromosomal changes due to electromagnetic radiation and the few that have been carried out have shown conflicting results (see, for example, *MWN*, J/A87 and N/D91).

Since 1984, the institute's Dr. Jasminka Goldoni has been monitoring the health of 40 workers who maintain air traffic control radar in Zagreb. Over the years, she and her coworkers have documented changes in their eyes and

(continued on p.11)

« Power Line Talk »

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

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

«« »»

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

«« »»

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

«« »»

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

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

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

House Taps NIEHS To Lead National EMF Research Effort

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

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

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

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

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

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

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

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

Dutch Advisory Panel Discounts ELF Health Risks

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

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

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

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

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

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

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

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

Defining Prudent Avoidance Policies State by State

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

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

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

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

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

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

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

Members of an EMF advisory group in California disagreed

Prudent Avoidance Sought in Union Contract

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

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

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

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

Excerpts from the State Reports

Colorado...

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

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

Connecticut...

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

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

Texas...

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

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

Wisconsin...

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

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

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

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

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

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

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

Legal Notebook

Electrical Worker's Cancer Claim Rejected

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

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

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

TLPJ Seeks Release of EMF Documents

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

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

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

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

Michigan Utility Sued for Stray Voltage

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

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

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

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

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

Wisconsin Electric Offers $25 Million Settlement

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

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

HIGHLIGHTS

NCRP Steps Up NIER Activities

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

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

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

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

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

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

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

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

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

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

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

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

Other Police Radar Developments

RIT Study Shows Elevated Cancer Risks

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

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

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

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

Defendants Seek Dismissal In Bendure Case

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

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

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

New Case Filed In Ohio

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

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

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

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

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

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

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

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

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

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

60 Minutes *Investigating Police Radar–Cancer Link*

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

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

SAB Issues Critique of EPA EMF Research Plan

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

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

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

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

Among the subcommittee's conclusions are:

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

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

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

Magnetic Material Found in Human Brain Tissue

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

optimal for use as a magnet."

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

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

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

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

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

NIST and FAA To Test Avionics for Immunity to EMI

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

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

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

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

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

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

Navy Shelves Plans For Gulf Coast EMPRESS II Site

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

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

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

Opponents of the proposed site, which is about 25 nautical

Finnish VDT–Pregnancy Study: EMF Risks at Lower Levels

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

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

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

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

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

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

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

Gulf War EMP Weapon Reported

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

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

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

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

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

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

duration of her cellular phone use.

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

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

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

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

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

seven watts or less. This exclusion was the subject of controversy during the revision process, when it was first deleted and then reintroduced (see *MWN*, S/O89 and N/D90). According to NEC specifications, the P9000 has an output power of 0.6 watts and operates at 825-845 MHz.

While cellular phones have not previously been the subject of litigation over health effects, suits have been brought concerning exposure to radiofrequency radiation from broadcast towers (see *MWN*, S/O89 and N/D90) and microwave radiation from military radar (see *MWN*, N/D90) and police radar (see p.7 and *MWN*, M/A91, S/O91 and M/A92).

IRPA Drafts Advisory on Safety of Mobile Telephones

The International Non-Ionizing Radiation Committee (INIRC) of the International Radiation Protection Association (IRPA) is preparing a position statement on *Protection Against Electromagnetic Radiation from Mobile Telephones.*

INIRC's objective is "to make the manufacturers of devices and the network operators consider essential health aspects...to prevent adverse health effects," according to an April 3 draft of the statement obtained by *Microwave News.*

The draft rejects the controversial seven-watt exclusion clause, adopted by the American National Standards Institute (see *MWN*, S/O89 and N/D91), which assumes that devices with a power of less than seven watts will not affect health.

INIRC is also considering a recommendation that partial body exposures from portable radios, including cellular phones and walkie-talkies, be limited so that the temperature of any organ, including the eyes, is not raised by more than 1°C.

"The draft is still only under discussion and has not been adopted," Annette Duchêne, the secretary of INIRC, told *Microwave News* from her office outside Paris, France. She said that the draft was reviewed at INIRC's last meeting in mid-May in Vancouver, Canada, and that she does not expect its approval in the near future. Duchêne also said that at IRPA's May meeting, held in Montreal, Canada May 17-22, INIRC became the International Commission on Non-Ionizing Radiation Protection.

Meanwhile, one of the papers that has prompted concern over the potential health risks from hand-held radios has been published. "Energy Absorption Mechanism by Biological Bodies in the Near Field of Dipole Antennas Above 300 MHz," by Dr. Niels Kuster of the Swiss Federal Institute of Technology in Zurich and Dr. Quirino Balzano of Motorola in Fort Lauderdale, FL, appears in the February 1992 issue of the *IEEE Transactions on Vehicular Technology, 41*, pp.17-23 (see *MWN*, N/D90).

Croatian Radar Studies *(continued from p.1)*

blood, as well as in their brain activity. (Interestingly, she identified opacities in the posterior pole of the lens of some workers' eyes.) The men were exposed to 1250-1350 MHz microwaves at levels ranging between 10 $\mu W/cm^2$ and 20 mW/cm^2 but generally below 5 mW/cm^2. In a paper presented at the *1st Congress of the European Bioelectromagnetics Association* in January, Goldoni reported that, "Long-term occupational exposure to microwaves and radiofrequencies may damage sensitive organ systems." She published some preliminary results in *Health Physics* in 1990.

At the same time, a second team, headed by Garaj-Vrhovac, has been running a series of laboratory experiments. The researchers exposed both human lymphocytes and Chinese hamster cells to 7.7 GHz microwaves (continuous wave) and found evidence of chromosomal aberrations and the formation of micronuclei (small fragments of chromosomes that are indicators of genetic changes). In both sets of studies, they concluded that the microwave radiation could cause genetic damage.

In a paper published in *Mutation Research* in 1991, Garaj-Vrhovac and Drs. Durda Horvat and Zlatko Koren concluded that "microwave radiation can induce damage in the structure of chromosomal DNA" in the hamster cells. Garaj-Vrhovac published similar findings on the human cells in *Mutation Research* earlier this year.

Koren, a professor of electrical engineering at the University of Zagreb, is also active in encouraging European research and cooperation in the field of non-ionizing radiation (see *MWN*, J/F92).

But the clearest evidence of the genetic risks of microwave radiation came in 1990, when six of the men whose health was being monitored by Goldoni were accidentally exposed to abnormally high levels of microwave radiation. A radar was mistakenly turned on while they were working nearby—the precise extent of their exposures is unclear. All six were found to have chromosomal aberrations, but later examinations showed that these decreased over time.

When Garaj-Vrhovac compared their chromosomal changes with those of human lymphocytes exposed to 7.7 GHz microwaves in cell cultures, she found the same types of aberrations in the two sets of samples. High levels of microwave radiation increase chromosomal aberrations, she said, emphasizing that it is now time to identify the exposure threshold for genetic activity.

Goldoni is continuing to analyze her epidemiological data and plans to complete her study by the end of the year. At the same time, she and the other Zagreb researchers are investigating the effects of low frequency electromagnetic fields (EMFs). "We are now turning our attention to power frequency EMFs, though we plan to continue our work with microwaves," Koren told *Microwave News.*

The ongoing war in the region is forcing many people to work with radar. "We will be following these people after the war, to see if we can detect any effects of the radiation and to see

if we can develop a dose–response relationship," Koren said.

Koren is interested in hearing from other researchers pursuing similar types of studies. Contact: Professor Zlatko Koren, Faculty of Electrical Engineering, University of Zagreb, Unska 3, 41000 Zagreb, Croatia, (38+41) 629 606; fax: (38+41) 611 396.

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— *Commentary*

Radar Radiation: A Call for Research

The new Croatian radar studies (see p.1) and the continuing uproar over police radar (see p.7) demonstrate that U.S. health agencies are neglecting a potentially significant occupational and public health issue. It is ironic that the efforts of a country as small as Croatia overshadow those of the U.S., where radar is an essential part of military technology, air traffic control and police enforcement.

The results from the University of Zagreb are consistent with other research findings—especially those from Sweden—which point to serious biological and health effects that have nothing to do with heating.

At a time when there is a consensus on the need for more research on ELF EMFs, we must also step up work on the RF/MW frequencies. The Environmental Protection Agency panel that just completed its review of the agency's cancer report made a special plea to not ignore RF/MW radiation: "The report should...declare explicitly that the attention given to non-ionizing EMFs derives in the first place from long-standing concern over the hazards of [RF/MW] radiation" (see *MWN*, J/A91 and J/F92).

Indeed, Sir Richard Doll, who chaired the National Radiological Protection Board advisory group that recently issued a report on EMFs in the U.K., concluded that the cancer risk from RF/MW radiation is of greater concern than that from ELF EMFs (see *MWN*, M/A92).

The first step is to expand on the research now being done almost exclusively by the U.S. Air Force (USAF) and the other branches of the Department of Defense. The health agencies must establish their own credible programs free of real or perceived conflicts of interest—as is being considered for the national EMF research effort (see p.13).

Much needs to be done. Here's how to start:

- Initiate a national epidemiological study of cancer, especially testicular cancer, among police officers using traffic radar, as recently urged by Sen. Christopher Dodd (D-CT) (see p.7). At the same time, a second study should investigate those exposed to the more powerful military and civilian radars.
- Resume work on the effects on the blood–brain barrier. Despite a succession of provocative results over the last 15 years, the military continues to push this subject under the rug (see *MWN*, S81, S/O86 and J/A88). The Swedes and the Canadians *are* pursuing this line of research—not only over concern about hazards but also for its potential as a way of delivering drugs to the brain (see *MWN*, J/F92).
- Pursue the equally compelling Swedish findings showing changes in the cerebrospinal fluid of radar workers (see *MWN*, My85 and M/J89).
- Increase support for the Johns Hopkins University and Food and Drug Administration studies on microwave effects on the eyes, with special emphasis on the observed drug–microwave synergy. Due to a lack of funding, this important work is moving too slowly (see *MWN*, J/A83, S/O86, J/A87, J/A88 and S/O91).
- Follow up the medical histories of workers injured by radar. In almost every case, the USAF and the Navy have refused to monitor the long-term health of those accidentally overexposed (see *MWN*, J/A86 and J/F88).
- Investigate the possible link between a cancer cluster among residents of a Florida housing development and a nearby FAA–USAF radar (see *MWN*, J/F92).

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House Report on National EMF Research Program

Excerpted below is the text of the House Committee on Science, Space and Technology report (No.102-474, Part 2, pp.117-124) on the Comprehensive National Energy Policy Act (H.R.776), which includes the Brown–Scheuer bill for a National Electric and Magnetic Fields Research Program (NERP)—see MWN, *N/D91, J/F92 and M/A92. We have omitted a section on the DOE as the lead agency, since the bill has since been amended to assign this responsibility to NIEHS (see p.3). Nevertheless, the report is written in terms of delegating tasks to the Secretary of the DOE.*

Background

1. Scientific Background: In recent years the public has become increasingly concerned that exposure to EMFs may pose a threat to human health....The available scientific evidence is extremely ambiguous and suggests that if there are health effects for EMFs they do not follow a traditional dose–response relationship...

2. Economic and Regulatory Effects: Amid the scientific uncertainty surrounding potential health effects of EMF exposure, pressure to reduce or avoid public exposure to high levels of EMFs has been building....

3. Current Research and Need for NERP: Though there is some pressure for regulation of EMF exposure, few people argue that it is appropriate to regulate at this time given the scientific uncertainty concerning safety. In fact, premature regulation of field strength could prove not only costly but also counterproductive if another parameter of the fields were found to be responsible for producing adverse health effects. The primary need conveyed by virtually all parties concerned with the EMF issue including utilities, computer and electrical equipment manufacturers, labor unions and public interest groups, is for an increased level of credible, high-quality research focused on health effects.

At present, federal research on EMFs is concentrated primarily in DOE, which received $5 million for EMF research and was designated the lead federal agency for such research in the FY92 Energy and Water Development Appropriation. DOE's FY93 budget request for this area is up $2.5 million to $7.5 million. EPA also receives funding for EMF research at a level of $1.9 million and has requested the same amount for FY93....

In order to avoid spending money on research which may not be perceived as credible and in order to establish a mechanism for coordination of EMF research on a national level, a large number of utility and electric equipment groups are interested in cofunding with the federal government a [NERP]. Sponsorship by the federal government, with appropriate peer review, would increase public credibility of the research while cofunding by nonfederal entities such as industry and states would enable an accelerated research program designed to answer the questions surrounding EMFs as soon as possible.

Explanation

The program...attempts to address the lack of coordination within the federal government and among the federal government, states and industry; the need for increased research...and the need to achieve and maintain high public credibility for EMF research. In order to increase coordination among those conducting or interested in EMF research, the legislation establishes a committee of representatives from federal agencies to coordinate the federal research effort and an advisory committee of representatives from states, unions, industry and public interest groups. To address the need for increased research, the legislation authorizes a five-year, $60 million research program to be cofunded by voluntary contributions from the nonfederal sector. In order to ensure the credibility of the research program, mechanisms for scientific peer review of proposals and conflict-of-interest provisions for researchers are included in the legislation.

1. Interagency Committee [IC]: [This committee will] coordinate the work of all the federal agencies involved in EMF issues....The committee intends that the IC should be a working-level group whose members have expertise in issues relating to EMFs....The IC is directed to develop a comprehensive agenda for research on the possible human health effects of EMFs and to update that agenda on a biennial basis to reflect new information....The agenda should focus primarily on 60 Hz EMFs...The committee does not intend to exclude completely related research on [ELF EMFs] and on [VLF EMFs], however, and encourages research on frequencies typical of emissions by [VDTs].

2. Advisory Committee [AC]:...The AC is to be composed of representatives from state regulatory agencies, state health agencies, electrical utilities, electrical equipment manufacturers, labor unions and public interest groups....The AC, therefore, is directed to establish priorities within the research agenda developed by the IC and to update those priorities as necessary to reflect new information....

3. NERP: *A. Selection of Projects:*...In order to ensure high-quality, credible science, the Secretary shall submit all the research proposals to at least one peer review panel of scientific and technical experts... *B. Reporting of Research:* The legislation requires that researchers submit reports to the National Academy of Sciences [NAS], the IC, and the AC summarizing the activities and results of their projects. The NAS is directed to submit annual reports to the IC and AC which evaluate completed research and make recommendations as to how to transfer information gained through the program to states, industry, unions and the public. The IC and AC are also directed to submit annual reports to Congress...The committee further intends that all results of the research program shall be available to the public and especially encourages researchers to publish their results in the peer-reviewed scientific literature. *C. Conflicts of Interest:* The committee and many of the groups supporting the concept of the NERP are particularly concerned that the research program should be as free of bias and conflict of interest as possible....The issue of credibility has been an especially sensitive one in the development of this legislation because of serious credibility problems with an asbestos research program sponsored by the EPA and industry and conducted by the Health Effects Institute....

In order to avoid a similar situation with this research program, the legislation specifies that the Secretary shall include conflict-of-interest provisions in grants and contracts which require researchers to disclose all funds received for consulting work and for related research and which prohibit researchers from testifying in court on research they are performing for the NERP. Researchers may testify on other research they have performed or are conducting. However, the spirit of the conflict-of-interest provisions precludes testimony on any research which bears a direct relationship to a researcher's work for the NERP. The provisions apply only to the time during which a researcher is conducting projects for the program.

4. EMFs Public Information Dissemination Program: [A] responsible and effective information program on EMF should take into account the complex and ambiguous nature of current scientific knowledge about possible health effects...

Cost-Sharing

...The Secretary is directed to obtain 50% of the total funding for research to be funded in each given year from offsetting receipts voluntarily contributed by nonfederal entities....In the event that the Secretary does not obtain nonfederal contributions to fund the research efforts in a given year, however, the legislation gives the Secretary the authority to fund research projects whose probable benefits the Secretary considers to outweigh the public interest in acquiring 50% funding from nonfederal sources....

UPDATES

EXPOSURE ASSESSMENT

Telephone Company Employees... Bellcore, the research arm of the regional Bell companies, has completed a survey of the ELF EMF exposures of telecommunications workers and has determined that "differences between occupational and nonoccupational magnetic field exposures are not very large." At randomly selected work sites, about 300 employees wore EMDEX C meters as they went about their usual work routines. Data from these subjects were compared with exposure measurements for about 30 workers who agreed to wear the meters outside of work. On the job, 95% of the participants had time-weighted exposure averages of less than 8.2 mG, and away from work, 95% had averages of less than 4.1 mG, according to an abstract of the results, which was presented at the *8th Annual Meeting of the Electromagnetic Energy Policy Alliance*, held May 4-6 in Alexandria, VA. David Rainer, Bellcore's director of environmental health and safety, who led the study, told *Microwave News* that the occupational exposure data were not analyzed by job category. Bellcore is not releasing the study, Rainer said. For more information, contact: Ron Riechmann, Bellcore, 1D-150, 290 West Mount Pleasant Ave., Livingston, NJ 07039, (201) 740-6129.

Canadian Survey... TransAlta Utilities Corp. in Calgary, Alberta, has measured EMFs at sites across Canada for the Canadian Electrical Association (CEA). Measurements were made at a variety of utility facilities and at 243 residences and 14 workplaces. Generating plants were found to have the strongest magnetic fields—up to 2 G. Substation magnetic fields were less than 20 mG; transmission line magnetic fields, measured 30 meters from the center line, were less than 30 mG. The report states that magnetic fields in residences "can vary tremendously, depending on proximity to power lines, characteristics of the household wiring and appliance use." *Measurement of Electric and Magnetic Fields*, Report No. 272T677, is available for $500.00 (U.S.) from: Carmelina Aparicio, CEA, 1 Westmount Sq., Suite 1600, Montreal, Quebec H3Z 2P9, Canada, (514) 937-6181, ext.317.

MOSCOW EMBASSY

Activating the Great Seal... In his new book, *Molehunt: The Secret Search for Traitors That Shattered the CIA*, David Wise sheds new light on the continuing enigma of why the Soviet Union beamed microwaves at the U.S. embassy in Moscow for many years beginning in the 1950s (see *MWN*, Ja81, D83 and M/A88). His source on this topic is Peter Karlow, a former OSS and CIA official who, according to Wise, is as close as one can get to an American "Q"—Ian Fleming's fictional character who equipped James Bond with high-tech gadgetry. Karlow described how the CIA found a listening device planted in a replica of the Great Seal of the U.S., which had been presented to the Americans by the Soviets and placed in the ambassador's office. Karlow told Wise: "There was a passive device inside the seal, like a tadpole, with a little tail. The Soviets had a microwave signal beamed at the embassy that caused the receptors inside the seal to resonate." Wise explains that, "A human voice would affect the way the device resonated, allowing the words to be picked up." His book was published by Random House earlier this year.

OVENS

Microwaving Breast Milk... Using a microwave oven to reheat a mother's breast milk diminishes the milk's infection-fighting properties, according to researchers at the Stanford University School of Medicine in Stanford, CA. "This preliminary study suggests that microwaving human milk could be detrimental," they write in the April 1992 issue of *Pediatrics*. The team, led by Dr. John Kerner, demonstrated that microwaving human breast milk to low (20-53°C) or high (72-98°C) temperatures breaks down antibodies and proteins that inhibit bacterial growth and fight infection. In a separate experiment, they showed that milk heated to at least 98°C in a microwave oven and then dosed with *E. coli* grew 18 times the bacteria of milk that had not been heated; even milk heated to low temperatures (20-25°C) had five times as much bacterial growth. All samples, including unmicrowaved controls, had been frozen and were allowed to thaw at room temperature. The paper argues that the diminished anti-infective properties "are difficult to explain" based on heating alone. Storing breast milk in freezers and heating it in microwave ovens is now a matter of course in many intensive care nurseries, the authors point out. The Stanford study comes on the heels of a World Health Organization (WHO) report, which found no evidence that cooking with microwaves induces harmful effects (see *MWN*, M/A92). (For more on microwave ovens and cooking, see *MWN*, S/O88, M/A89 and M/J90.)

PEOPLE

At its annual meeting, held on April 2, the National Council on Radiation Protection and Measurements (NCRP) elected nine new members, including Dr. **David Hoel** of NIEHS, Dr. **Gilbert Omenn** of the University of Washington, Seattle and **David Sliney** of the U.S. Army Environmental Hygiene Agency. In addition, Dr. **Bill Guy** of the University of Washington, Seattle was reelected and Dr. **Leonard Sagan** was elected an honorary member....Dr. **Samuel Milham Jr.** has retired from the Washington State Department of Health. He plans to continue to do research and to consult on EMF issues....Dr. **Abe Liboff** of Oakland University in Rochester, MI was presented the Humanitarian Award by the Robert Carl Strom Foundation at the foundation's annual meeting, held in Ann Arbor, MI on May 15 (see *MWN*, M/A92). Liboff was cited for his "pioneering work" on EMF bioeffects....**Jesse Russell Sr.**, the director of AT&T Wireless Systems & Services Architecture Center at Bell Labs, has been elected president of the Electromagnetic Energy Policy Alliance. Previously, Russell was the director of AT&T's Cellular Telecommunications Lab....Epidemiologist Dr. **Doreen Hill** is leaving EPA's Office of Radiation Programs to join Energetics, a consulting firm in Columbia, MD, where she will

work on EMFs with **Ken Klein**, a DOE alumnus....**Tom Watson** of Crowell & Moring in Washington, DC is profiled in the May issue of *The Washingtonian*, under the headline, "Power Player: When Electric Companies Get Sued, They Call the Man in the Lizard-Skin Boots." The profile notes that Watson "now has some 90 U.S. utilities and 80 foreign power companies as clients."...Dr. **Irving Selikoff**, a leading researcher on the hazards of asbestos, died May 20. At Mt. Sinai Medical Center in New York City, Selikoff initiated one of the first studies on the reproductive risks of VDT EMFs (see *MWN*, Jun85).

RESOURCES

Video on Undergrounding...Tom Maney has produced a video that makes a case for the economic benefits of burying power lines. Maney, a professor emeritus of electric power engineering at the University of Kentucky, concedes that the construction costs of burial are greater than those for stringing overhead lines. But he argues that when the economic impacts of contact injuries, power outages, chemical pollution from treated poles, car accidents with poles and losses in property values are factored in, burial is the preferred option. The 45-minute video, which is very much like a college lecture—Maney presents his argument in a series of charts—is available for $20.00 from: Tom Maney, 116 Methodist Ave., Fort Walton Beach, FL 32548, (904) 243-7200.

EMFs and Land Use...The American Planning Association (APA) has published *Electromagnetic Fields and Land-Use Controls* by Dr. Louis Slesin and Matthew Connelly of *Microwave News* and David Bergman of the APA. (Connelly is now a doctoral candidate at Yale University.) The 20-page report, No.435 in APA's Planning Advisory Service (PAS) series, is available for $24.00 ($12.00 for PAS members), plus $5.00 postage and handling, from: APA, 1313 East 60th St., Chicago, IL 60637, (312) 955-9100.

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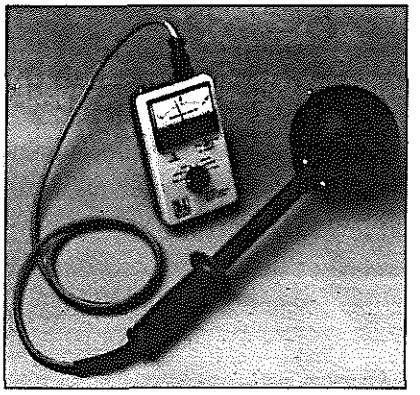
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STANDARDS

1991 IEEE RF/MW Limits Challenged...Hammett & Edison (H&E), a consulting engineering firm in San Francisco, CA, is opposing ANSI's adoption of the 1991 IEEE safety limits for exposure to RF/MW radiation (see *MWN*, N/D91). "We feel that...the proposed standard would cause significant, and entirely unwarranted, hardships to VHF low-band television stations and to FM stations below 100 MHz," H&E's Dane Ericksen told *Microwave News*. In an April 17 letter to the IEEE, Ericksen complained that H&E saw "*no scientific justification* for the selection of 100 MHz as a cut-off point" for induced body currents (his emphasis). "If the IEEE C95.1 standard is left unchanged, one has the nonsensical situation of having a conducted body current limit for a 3 kW Class A FM station at 99.9 MHz, but no limit whatsoever for a 100 kW Class C FM station at 100.1 MHz," Ericksen wrote. He asked that the body current limits only apply up to 40 MHz. In response to an earlier letter from H&E, Dr. Om Gandhi of the University of Utah, Salt Lake City, the cochair of the subcommittee that developed the 1991 standard, replied that the "safety guidelines are based on the science of coupling of [EMFs] to humans" and that the "subcommittee decided not to get involved in proposing safety guidelines by industry or applications." H&E has sought to clarify RF rules in the past (see *MWN*, S/O87 and S/O89).

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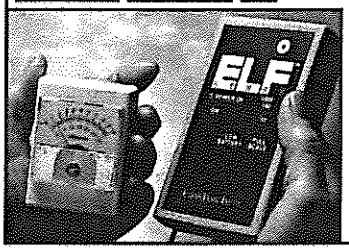
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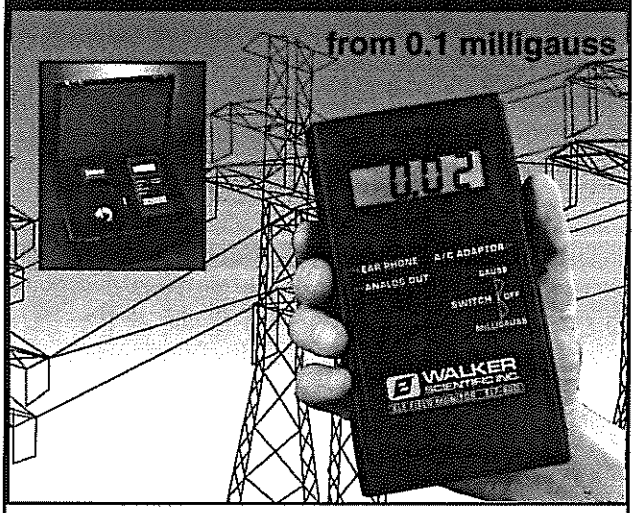
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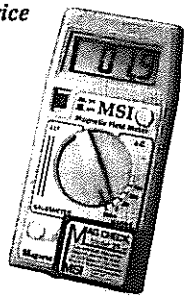
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California Utility Wins EMF–Childhood Cancer Case

A 12-person jury has found that the San Diego Gas & Electric Co. (SDG&E) was not negligent in failing to warn its customers about the potential health effects of electromagnetic fields (EMFs). The plaintiffs, Ted and Michelle Zuidema, had alleged that their daughter, Mallory, developed a rare kidney cancer due to exposure to EMFs from SDG&E transmission and distribution lines. The Zuidemas have not yet decided whether to appeal the April 30 decision.

"The jury's decision just reinforced what most people think and what industry has been saying for a long time—that power lines don't have ill health effects," said Duncan Barr of the San Francisco firm of O'Connor, Cohn, Dillon & Barr, who represented SDG&E.

But one of the Zuidemas' lawyers, Michael Withey of the Seattle firm of Schroeter, Goldmark & Bender, contends that a broad interpretation of the defeat is not justified. "The jury did not resolve any of the thorny medical causation issues," he said, referring to the question of whether EMFs from SDG&E power lines had caused the Zuidemas' daughter to develop cancer.

In their suit, filed on May 29, 1991, in California Superior Court in San Diego, the Zuidemas claimed that Mallory, now five years old, developed nephroblastomatosis while still in her mother's womb—which later led to Wilms' tumors—from power line EMFs (see *MWN*, J/A91 and N/D92). At 26 months, Mallory had seven golf ball-sized tumors removed from her kidneys. Her cancer is now in remission.

(continued on p.7)

Is IGF-II the Missing Link?

One of the mysteries surrounding the Zuidema case is why experienced lawyers chose a kidney cancer case to establish the EMF–cancer risk. After all, the best-known studies have linked EMFs to leukemia and brain cancer, but not to Wilms' tumors.

There may in fact be a connection, however tenuous. The bridge is IGF-II, insulin growth factor-II. This protein was linked to Wilms' tumors as early as 1985.[1] Indeed, on the witness stand, Dr. Bruce Beckwith, who has been described as SDG&E's star witness, agreed with Michael Withey, one of the Zuidemas' lawyers, that IGF-II "is probably very much involved in the pathogenesis of Wilms' tumor[s]."

Experimental data demonstrating the EMF–IGF-II link surfaced just a month before the trial. Ironically, it passed largely unnoticed because it was described in a patent and was not published in a scientific journal.

The patent says that a 15.3 Hz sinusoidal magnetic field under conditions of ion cyclotron resonance (ICR) could "significantly" increase the production of IGF-II in bone cells.[2] Over the last few years, a group under the direction of Dr. David Baylink at the VA hospital in Loma Linda, CA, has been working on

(continued on p.10)

« Power Line Talk »

Dr. **Genevieve Matanoski** and colleagues at the Johns Hopkins University (JHU) School of Hygiene and Public Health don't see eye to eye with the EMF managers at the Electric Power Research Institute (**EPRI**). In announcing the publication of Matanoski's final report on leukemia among telephone linemen late last year, EPRI summed up the results this way: "Overall, this study shows no relationship between leukemia mortality and employment as a telephone lineman." EPRI went on to say that there were some elevated risks, but that none was statistically significant. The JHU researchers see it differently: "The data suggest an increasing risk with increasing exposure," they wrote in the abstract of their paper, published this spring in the *American Journal of Epidemiology* (see *MWN*, J/A91 and M/A93). In an interview with *Microwave News*, Matanoski said that EPRI had "understated" her results and she stressed that there does appear to be an EMF effect with a dose–response relationship when total lifetime EMF exposures are estimated—up to a sixfold increased cancer risk. In a press release issued by the journal, Dr. **Patrick Breysse**, one of Matanoski's collaborators, explained that "more study needs to be done." The JHU researchers caused quite a stir when, in November 1989, at the same time as they were finishing up their EPRI study, they announced that they had observed statistically significant elevated rates of leukemia, lymphoma and prostate cancer, as well as the first suggestion of an EMF–male breast cancer link, among young linemen who worked for New York Telephone (see *MWN*, N/D89 and M/A91). The analysis of the New York data was sponsored by a small grant from the National Institute of Environmental Health Sciences, not by EPRI. Nevertheless, that same month, EPRI President Richard Balzhiser wrote to utility executives that the New York results "are preliminary and clearly warrant further study" and that EPRI is "committed to pursuing this work objectively by providing support to outstanding researchers in the field such as Matanoski." Breysse and Matanoski are eager to pursue the New York results—which Matanoski herself called "remarkable." Indeed, these as-yet-unpublished findings have already prompted a number of others to look into the possible breast cancer risk (see *MWN*, J/A90, J/F91, S/O91 and J/A92). Matanoski said that she will soon submit a paper on the New York study for publication and that she hopes to secure funds to continue this work.

«« »»

People aren't really concerned about EMFs—they just say they are in order to block the construction of power line towers, according to **Samuel Skinner**, who recently became president of the Chicago-based Commonwealth Edison Co. "The real issue...is not EMFs. It is the towers...and the impact they have on real estate," he told *The News-Sun*, an Illinois daily located in Waukegan. Skinner, formerly President Bush's chief of staff and, before that, Secretary of Transportation, also said that there is "not one study that says that living next to power lines is a serious hazardous risk," according to the May 6 article. The Swedish study linking power line EMFs to childhood leukemia, completed last fall, raised more questions than it resolved, Skinner said. Thomas Hemminger, an environmental services manager at Commonwealth Edison, clarified the utility's position for *Microwave News*. "We still don't know which aspect of EMFs is a causative agent—or if there is one," he said, adding that there has been no laboratory confirmation of the dose–response relationship between EMFs and cancer that was found in the Swedish epidemiological study (see *MWN*, S/O92). Nevertheless, several Illinois elected officials, citing health concerns about EMFs, have signed a petition to intervene in a Commonwealth Edison plan for a new power line. Attorney General Roland Burris, U.S. Rep. Philip Crane and state Sen. Adeline Geo-Karis have agreed to support Citizens Against Unsafe Electricity (CAUSE), a group based in Lake Villa that wants to reroute or bury the six-mile, 138 kV line that is planned to run past schools and homes between Antioch and Round Lake Beach.

«« »»

New York State will soon begin a reassessment of its EMF policy, including its interim 200 mG limit at the edge of power line rights-of-way, according to Dr. **Dan Driscoll** of the Department of Public Service. "We're very excited about this," Driscoll said, but he noted that many of the details of the plan have not been worked out. As it stands now, the Department of Health will review EMF research, and then the Public Service Commission (PSC) will decide whether to revise the standard. Each phase should take between six and nine months, Driscoll said, adding that other interested agencies will be invited to participate. The program was announced by Driscoll—who was recently named to the National Academy of Sciences-National Research Council's new EMF committee (see p.4)—at a May 13 town meeting in New York City sponsored by Assemblyman **Richard Gottfried**, chair of the Assembly Health Committee. Also at the town meeting were Dr. David Carpenter of the State University of New York School of Public Health and Dr. James Melius of the Department of Health. New York's 200 mG standard was adopted by the PSC nearly three years ago (see *MWN*, S/O90).

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U.S. utility executives see EMFs as their primary public policy concern, according to a new survey by **Alexander & Alexander Services** Inc., a New York-based international consulting and insurance firm that addresses risk management issues. No other environmental issue came even close: 88% of the risk managers said that EMFs from transmission lines and appliances were of "above average importance" and 59% said they were of "high importance." Alexander & Alexander noted that EMFs were raised in 201 court challenges to utility projects in 1992. A series of public opinion polls taken over the last few years by **Cambridge Reports/Research International** in Cambridge, MA, explains why the electric utilities are worried. In 1989, only 31% of adult Americans were aware of the EMF issue, but, by February 1993, the number had jumped to 63%. In addition, slightly less than half the people surveyed said that they would be "extremely worried" about the health, economic and aesthetic impacts of a new transmission line near their homes—approximately double the level of four years ago. What should the

utilities do? Writing in the May-June issue of *Electric Perspectives,* published by the **Edison Electric Institute,** Gene Pokorny, the chairman of Cambridge Reports, advises utilities to continue "an open process of dialogue." On the other hand, ***Electrical World,*** a McGraw-Hill publication, has some different advice: "Stop talking about EMF." In a commentary in their March issue, the editors prescribe "a little benign neglect" because, they say, it is "irresponsible" to spend millions of dollars "on a phenomenon that almost every knowledgeable person now agrees has a very low probability of significant health risk."

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In its official report to the General Assembly, the **Connecticut Interagency EMF Task Force** set forth the policy it calls **voluntary exposure control** (VEC). The strategy best answers the question of how an agency should "formulate policy in the face of such uncertain science," according to the report, released in March. The plan first surfaced in an October 13, 1992, letter from Department of Health Services (DHS) Commissioner Susan Addiss to state Sen. Cornelius O'Leary (see *MWN,* N/D 92). VEC calls for "a pro-active program of providing information to the community about EMF and factors to consider if concerned individuals decide to reduce their exposure." The task force steered clear of "prudent avoidance," warning that it is "a difficult term to employ in public policy." The group explained in its report that prudent avoidance can be interpreted to apply both to individuals and to electric utilities, while VEC applies only to individuals. The report does not specify a role for utilities. The decision to recommend VEC was also influenced by an April 1992 study by the Connecticut Academy of Science and Engineering, which found that it would be "inappropriate" to adopt prudent avoidance (see *MWN,* M/J92). The task force, which was created in July 1991 (see *MWN,* J/A91) and is chaired by Dr. Peter Galbraith of the DHS, will continue to monitor scientific evidence on EMFs and will submit an update to the legislature by February 1995. For a copy of the task force's report, contact: Connecticut DHS, 150 Washington St., Hartford, CT 06106, (203) 566-8167.

Sweden Weighs 2-10 mG Limit; Draft Proposal Due by Year's End

By the end of the year, Swedish officials will circulate a draft proposal for a national magnetic field exposure limit for new power lines and substations, according to Stefan Villa of Sweden's newly formed National Electrical Safety Board. Villa said that the board is considering a standard of 2, 5 or 10 mG and is analyzing the costs associated with meeting each of these levels. If adopted, the standard would also apply to new residential buildings located next to existing power lines and substations.

A working group has also been established by the board to estimate the number of people in schools, day-care centers and residential buildings now exposed to magnetic fields from existing power lines and substations, as well as the cost of reducing these fields.

Electric utilities, government agencies and research centers are working with the board, Villa said. Any proposals made by the board will be widely circulated for comment among government agencies and other interested parties before a final decision is reached, Villa explained.

Last September 30, Sweden's National Board for Industrial and Technical Development, NUTEK, announced that it would "act on the assumption that there is a connection between exposure to power frequency magnetic fields and cancer" (see *MWN,* S/O92). This policy was prompted by the release of Maria Feychting and Dr. Anders Ahlbom's study, and prior epidemiological studies, linking residential exposures to an increased rate of childhood leukemia. While the Electrical Safety Board—the government agency which took over responsibility for EMF guidelines on January 1—"does not believe that an absolutely certain correlation exists," Villa stated, "a correlation is sufficiently probable to warrant consideration and action in the form of further studies."

Earlier this year, the Swedish Institute for Radiation Protection, based in Stockholm, advised that the available research "speaks in favor of taking steps to reduce the fields"—but that these measures should have a lower priority than reducing exposures from sources such as radon and UV radiation. The institute argued that magnetic field exposures from new equipment and power lines should be reduced "provided [that] these solutions do not imply large inconveniences or costs" and that steps to reduce exposure from existing installations should be deferred unless fields exceed normal levels "by more than tens of times."

Rolf Lindgren, the EMF manager for the state power company, Vattenfall, predicted that "future regulations will most probably apply only to new electrical plants and houses."

International NIR Commission: Cancer Data Still Inconclusive

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) has affirmed its position that research to date is insufficient to conclude that exposure to EMFs increases cancer risks.

In a statement released following its annual meeting, held in Neuherberg, Germany, May 7-12, ICNIRP concluded that, despite improvements in the methodology of some laboratory and epidemiological studies, "the data related to cancer do not provide a basis for health-risk assessment of human exposure to power frequency fields."

ICNIRP has thus endorsed the EMF guidelines it adopted on an interim basis in 1989 and published in 1990. They allow unlimited exposures of up to 1,000 mG and 5,000 mG for the general public and workers, respectively (see *MWN,* M/J89 and J/F 90). The guidelines were actually written by ICNIRP's predecessor, the International Non-Ionizing Radiation Committee of the International Radiation Protection Association (IRPA). In

1992, IRPA approved a new charter for ICNIRP, granting it greater independence (see *MWN*, J/F92).

At the meeting, the commission also approved limits for human exposures to static magnetic fields. These will be published in a future issue of *Health Physics*. ICNIRP said that it will continue to review the EMF–cancer literature periodically.

Rüdiger Matthes of the German Institute for Radiation Hygiene in Neuherberg has replaced Annette Duchêne as the commission's scientific secretary. Dr. Michael Repacholi of the Australian Radiation Laboratory in Yallambie, Victoria, continues to chair ICNIRP.

Legislators Seek Labeling of Appliances That Emit High EMFs

In an effort to educate consumers and encourage appliance manufacturers to reduce EMFs, federal and state legislators have introduced bills requiring the labeling of products that emit high electric and magnetic fields. Virtually no appliances currently list such information, except video display terminals (VDTs) that comply with the Swedish low emission standards.

In Congress, the Electromagnetic Labeling Act of 1993 (H.R.1982) was introduced on May 5 by Rep. Leslie Byrne (D-VA). The bill would require manufacturers to put a label on appliances indicating the strength of the emitted electric and magnetic fields. "We wanted something that wouldn't be burdensome on industry but would provide consumers with information they could use to comparison shop," Julia Lyman, a spokeswoman for Byrne, told *Microwave News*.

The bill would apply to products that emit electric and magnetic fields of at least 100 V/m and 1 G, respectively, at a distance of one inch. The limits were set in response to recommendations by the Congressional Research Service, according to Michael Day, a legislative assistant to Byrne. He said that the measure would affect products such as microwave ovens, TVs, VDTs and refrigerators. He noted that Byrne is open to revising the 1 G threshold.

The bill, which has no cosponsors yet, has been referred to the subcomittee on energy and power of the House Committee on Energy and Commerce. H.R.1982 replaces H.R.1665, introduced by Byrne in April, which had set the electric field limit at 100 mV/m.

Meanwhile, New York state Sen. Suzi Oppenheimer introduced a bill (SB2858) on March 2 requiring that electric-blanket makers indicate the strength of the EMFs their products emit, as measured "at a range of less than one inch." The bill was prompted by Oppenheimer's concerns about long-term exposures to high magnetic fields, according to Steve Otis, Oppenheimer's legislative counsel.

"This legislation will give consumers the ability to make their own judgments about the electric blankets that they purchase," Oppenheimer said. Otis added that such a law would also give manufacturers an impetus to design electric blankets that emit low EMFs.

The bill was assigned to the Consumer Protection Committee on March 2. The senator introduced a similar measure last year, which was still pending when the session ended.

In Pennsylvania, the Household Appliance Electromagnetic Field Disclosure Act (HB1610) was introduced by Rep. Bruce Smith on May 10. The measure would require that sellers of household products—including kitchen appliances, power tools, TVs, computers, electric blankets and hair dryers—post notices listing EMF emissions. A sign would indicate magnetic fields measured within one foot of the product and at a distance of three feet. The notice would also contain a warning that exposure to EMFs "may increase the risk of serious illness."

"It delivers the message that the farther away you are, the lower the EMFs," Smith said in a telephone interview, adding that his intent "is not to scare people, but to educate them." Smith said that his involvement with a citizens' group that is fighting a 268-mile, 500 kV line in the state "got him thinking about EMFs and appliances." HB1610 was referred to the Committee on Labor Relations on May 10.

For more on electric-blanket EMFs and health, see *MWN*, M/J90, J/F92, J/A92 and M/A93.

NAS-NRC EMF Committee

The National Academy of Sciences (NAS)-National Research Council's (NRC) Board on Radiation Effects Research has announced the members of a committee to review the potential health risks from EMF exposures. The committee will focus on the effects of extremely low frequency fields—especially 60 Hz—on cancer, reproduction and development and learning. Where there are sufficient health data, the committee will do a risk assessment, and where there are gaps, a research strategy will be developed.

Congress mandated the NAS-NRC study in August 1991, appropriating $600,000 for the task (see *MWN*, S/O91). Dr. Larry Toburen, the board's staff officer, told *Microwave News* that it took a long time to identify committee members and to negotiate the study plan with the Department of Energy, which is responsible for the project. Toburen predicts that the committee will complete its work in approximately two years.

Dr. Charles Stevens, a neurobiologist at the Salk Institute in La Jolla, CA, is the committee chairman and Dr. David Savitz, an epidemiologist at the University of North Carolina, Chapel Hill, is the vice-chairman. The other members are: Drs. Larry Anderson, Battelle Pacific Northwest Labs, Richland, WA; Daniel Driscoll, New York State Department of Public Service, Albany; Fred Gage, University of California, La Jolla; Richard Garwin, IBM Watson Research Center, Yorktown Heights, NY; Lynn Jelinski, Cornell University, Ithaca, NY; Bruce Kelman, Failure Analysis Associates Inc., Menlo Park, CA; Richard Luben, University of California, Riverside; Frederick Mosteller, Harvard University, Cambridge, MA; Russel Reiter, University of Texas, San Antonio; Malvin Ruderman, Columbia University, New York; Paul Slovic, Decision Research, Eugene, OR; Jan Stolwijk, Yale University School of Medicine, New Haven, CT; Maria Stuchly, University of Victoria, Victoria, BC, Canada; Daniel Wartenberg, Environmental and Occupational Health Sciences Institute, Piscataway, NJ; John Waugh, Massachusetts Institute of Technology, Cambridge; and Jerry Williams, Johns Hopkins University, Baltimore.

FROM THE FIELD

EMF Exposure Assessment Beyond Time-Weighted Averages

To the Editor:

The observed association between wiring configuration and childhood leukemia published some 15 years ago (Wertheimer and Leeper, 1979) remains a landmark contribution to the scientific literature and the salient impetus to research into possible health effects from exposure to ELF magnetic fields. Since 1979 several residential epidemiological studies have been published, some of which support an association between magnetic field exposure and increased risk for certain cancers, and some of which do not. This lack of replicability, despite refinement of the proxy exposure metric, or so-called wiring code, is perplexing. Researchers in the EMF area seem quite willing to accept the wiring code as a surrogate for magnetic field exposure, even though it correlates only weakly with spot and long-term measurements of actual residential magnetic fields. In most epidemiological studies, measured magnetic fields in homes, when reported as the time-weighted average (TWA), do not correlate well with increased risk for disease.

TWAs and their surrogates have been used because they are easy to assess and because the TWAs fit into the concept of dose that has been successful in radiation biology and chemical toxicology. Despite the fact that we live in a complex environment of EMFs, epidemiological studies on the issue of possible EMF-related health effects have focused almost exclusively on implicit surrogates of the TWA or measured TWAs in the 50-60 Hz power line frequency band. Overall, the studies reporting an association imply that relative risk for leukemia increases at TWAs of 2-3 mG or greater.

We suggest that the time has come to seriously consider attributes of magnetic fields, in addition to the TWA, to which people are exposed. Short-term exposure to high flux densities is one example. Gauger (1985) has measured 60 Hz peak magnetic fields from household appliances and found a number of models of different hand-held electrical devices capable of generating 500-2,000 μT (5-20 G) fields at their surface. While the transient induced currents resulting from such exposures would far exceed minimum levels held by some physicists to be detectable by biological systems, these exposures translate into a trivial contribution to the 24-hour TWA. Any number of field attributes other than 50-60 Hz peak flux density may also be important, including higher frequency components and the time rate of change.

We have recently measured the fields generated by a number of hand-held personal appliances, such as AC-powered massage units, electric razors and hair dryers, that can contribute to the everyday EMF exposure of individuals who use them. Among these appliances are many models that generate frequency components in the 10^6 Hz range, magnetic field flux densities exceeding 1 mT (10 G) at 60 Hz rms, and rates of change far exceeding 1,000 T/sec (10^7 G/sec) measured at the surface of the appliance. Such appliances are used in contact with, or in close proximity to, the body and the resulting induced currents in the body 1) increase as a function of the magnetic field frequency; 2) increase as a function of the flux density at a given frequency; and 3) are proportional to the incident magnetic field time rate of change.

Based on these electrical appliance data, from our and other laboratories, we suggest that certain assumptions implicit in most of the epidemiological work to date should be questioned. These assumptions are 1) that the frequency of residential magnetic fields is exclusively in the 50-60 Hz range with negligible contributions from higher harmonics; 2) that residential magnetic fields are of relatively low flux density—e.g., below 50 μT (500 mG); and 3) that the parameter of interest in determining dose from exposure to these fields is the TWA magnetic field flux density.

Of these assumptions, the first two, if valid, limit the magnitude of the induced electrical fields, and hence the currents, that residential magnetic fields can produce in biological tissue. While the first two assumptions may indeed be valid as they apply to magnetic fields from power lines near the home, they are not applicable when considering magnetic fields from electrical devices used in close proximity to the body.

There is ample evidence from both laboratory animal and human studies, including applications in clinical medicine (Sharrard, 1990), that episodic or periodic intermittent exposure to magnetic fields of sufficient flux density can give rise to readily measurable physiological effects. In human studies, for example, the effects of exposure on the cardiac interbeat interval (Cook et al., 1992) and on EEG (Lyskov et al., 1993) were more pronounced when subjects were exposed to an intermittent magnetic field as compared with exposure to a steady state field of the same flux density. In hamsters, 15 minutes of exposure to a 60 Hz magnetic field of 0.1 mT (1 G) appears sufficient to delay by two hours or more the subsequent night's periodic rise in the hormone melatonin (Yellon, 1991). Similar effects of short-term exposure have been reported for pulsed DC magnetic fields in the rat model (Lerchl et al., 1991). If considered on a TWA basis over 24 hours, such brief exposures to high flux density fields would fall into the category of "weak" magnetic field exposure—i.e. less than 1 μT (10 mG). Perhaps then, the third of the above assumptions, that TWA best represents dose, should also be reevaluated, because it is clear from the above studies that TWA fails to characterize the relevant exposure parameters for the effects observed.

Other attributes of these exposures that may be important in determining physiological activity include measures of the peak magnetic field (B_{max}), the time rate of change of the magnetic field (dB/dt) and the intermittent nature of some exposures. The TWA is a poor metric for such exposures.

In summary, there is now a great deal of relevant laboratory and human clinical data to support the hypothesis that TWA may not be the best magnetic field exposure metric. The time has come to look beyond the TWA metric in the effort to determine if a causal link exists between EMF exposure and risk of adverse health outcomes, including cancer.

Sincerely,

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Schools and EMFs: Actions Around the Country

A move to measure and limit power line EMFs at schools is gaining force around the country—in California, Connecticut, Maine, New Jersey and New York. Here is a roundup of the latest developments:

• The **California Department of Education** has set up a task force on EMFs in schools, according to Duwayne Brooks, the department's assistant superintendent for school facilities planning. Brooks told *Microwave News* that the idea was raised by Martha McNeal, EMF program director at Pacific Gas & Electric (PG&E), who said that she had been receiving calls of concern from people in the community. The 20-member task force is made up of parents, teachers and representatives of utilities and state agencies, including the Department of Health Services (DHS). The task force has met three times since it was established in April and plans another session for June 3. At its last meeting, on April 29, the DHS and utility representatives discussed steps to identify schools that are near transmission lines: "This could be the first phase of a larger study which would identify the sources and field strengths... and ultimately provide mitigation protocols," according to the minutes of the meeting. In 1988, the Department of Education set interim guidelines for siting new power lines and schools (see *MWN*, M/J88). They call for minimum distances of 100 feet from a 100-110 kV right-of-way (ROW), 150 feet from a 220-230 kV ROW and 250 feet from a 345 kV ROW.

• Parents, teachers and PG&E officials are considering four alternatives to reduce EMFs at the **Montague Elementary School** in **Santa Clara, CA**, where a 115 kV power line runs less than 75 feet away. The options include raising the power line poles or burying the lines, according to Marilyn Pope, a concerned parent. Magnetic fields measured between 3.7 and 10.2 mG in the classrooms and up to 16 mG on the playground. Four classrooms have already been closed. A total of five teachers and one janitor have been diagnosed with cancer, but there are no indications that these numbers are abnormal. Pope also said that there are two children in the neighborhood with Wilms' tumors (see p.1). Both live near the same 115 kV power line that runs by the school, which one of the children attends.

• The **Montecito Union Elementary School** in **Montecito, CA**, has nearly finished a survey identifying the areas where EMFs are between 1 and 2.5 mG, according to Cindy Sage, an environmental consultant based in Montecito. A 2.5 mG limit was set by the school three years ago. The survey is designed to find magnetic field sources and to help determine how they can be reduced and at what cost. The school board has not yet announced whether it will adopt a school EMF task force's recommendation of a 1 or 1.5 mG limit, said Sage, who is a member of the task force. In 1990, the board voted to limit magnetic field exposures in classrooms and play areas to 2.5 mG by relocating playgrounds and marking those sections that had EMF hot spots. A survey at the time showed average fields of 5 to 30 mG along the north side of the school and fields of about 1 mG in most classrooms. Sage said that the fields were due to a combination of interior wiring, a 66 kV overhead power line, several buried power lines and a substation. The task force has asked Southern California Edison, based in Rosemead, to consider moving the substation to a less populated area nearby. In 1989, the DHS identified a group of six children in Montecito with leukemia or lymphoma, four of whom had attended Montecito Union (see *MWN*, M/A90 and S/O90).

• PG&E has agreed to raise and reconfigure a 60 kV line to reduce EMFs near the **Tam Valley Elementary School** in **Mill Valley, CA**, according to Mike Patrick, business manager of the Mill Valley School District. The project will cost about $105,000 and will be paid for by the school district. Administrators had planned to build some new classrooms in between the power line and existing buildings until a parent raised concerns about EMFs. Measurements later revealed magnetic fields of 6.1 mG on a playing field directly below the line and EMFs of up to 1.2 mG in classrooms, Patrick said. The school board considered putting the new classrooms elsewhere, but then decided that it would be easier to modify the power line. There have been no reported health problems at the school, but nearby, a Mill Valley resident whose wife was diagnosed with cancer did an EMF survey of homes in his neighborhood, sensitizing the community to the issue. Along a two-mile stretch of road, he found that "eight out of nine households with high EMF readings also had cancer," according to a feature article by Peter White that appeared in the *San Francisco Examiner's Image* magazine on March 14.

• School officials near **Santa Rosa, CA**, will pay PG&E more than $20,000 to reconfigure a power line that runs by two elementary schools to reduce EMFs. They are concerned about recent studies that indicate that EMFs "can present a significant health concern," according to Ida Victorson, superintendent of the **Mark West Union Elementary School District**. Between 1982 and 1992, a total of six cases of cancer—three times the expected rate—were reported among students at the three schools in the district, according to DHS's Dr. Eva Glazer, who said that the cancer excess could be due to chance. Victorson stressed that school officials have not drawn a connection between EMFs and cancer at the schools. Two of the three schools in the district are located within 100 feet of a 230 kV power line owned by PG&E. The highest EMF reading in classrooms at the Mark West school measured more than 5 mG, while fields in other classrooms at Mark West and at the other school, San Miguel, were 4 mG or lower, Victorson said. School officials—who are also considering rewiring classrooms at the schools to mitigate EMFs—say they will try to get PG&E to pick up the cost of reconfiguring the line, particularly because it was sited after the schools had been built.

• Utilities in **New Jersey** agreed on April 20 to determine how many schools are within 100 feet of transmission lines of 69 kV or higher, according to the **State Board of Regulatory Commissioners** (BRC) in Trenton. "We've made a good start toward developing a solid base of information that will give us some answers on EMFs and if there is a level of risk to our schoolchildren," said BRC Commissioner Carmen Armenti. The state's four utilities said that they would begin assessing EMF exposures at the schools by early June. In an April 19 letter to Edward Salmon, president of the BRC, Paul Welch, chairman of the Committee for Safe Power Lines in Little Silver, pointed out that restricting the survey to transmission lines operating at 69 kV or above leaves out many schools in the state. Why not "check all schools near high current power lines of any voltage?" he asked.

• Following in the footsteps of **New York** State Attorney General Robert Abrams—who earlier this year got utilities to survey power lines near schools (see *MWN*, N/D92 and M/A93)—New York City's Community Board No. 2 wants all city schools to be surveyed for EMFs. The board passed a resolution on March 18 asking that "EMF readings be done in *all* schools, day care centers, nursery schools, playgrounds and other facilities where children spend much time, whether or not they are close to power generation and distribution facilities." Meanwhile, the **Voorheesville School** near **Albany** is setting up a program to reduce EMFs exposures from sources other than power lines, such as VDTs and lights. Earlier this spring, the Niagara Mohawk Power Corp. agreed to remove or reconfigure two power lines within 70 feet of the school.

• On April 15, **Maine** state Rep. Conrad Heeschen—who is active in the citizens group No Thank Q Hydro-Québec, based in Dryden—introduced two bills in an effort to obtain information about, and limit, schoolchildren's exposures to EMFs. But the plans were short-lived. Both measures were tabled by the Committee on Education on May 13. "It was very clear that utilities did not want to be asked by the legislature to do a survey," Heeschen told *Microwave News*. But he said that the utilities have agreed to measure EMFs if a school requests it, and that they would report their findings to the state Department of Education. Legislative Document (LD) 1275 would have required electric utilities to measure magnetic fields at schools within 100 feet of transmission lines operating at 34.5 kV or above. The second bill, *LD 1345, would have prohibited the construction of or expansion of* a school on property where EMFs measure 2 mG or more.

• A citizens group has formed in **Fairfield, CT**, to fight the construction of a 115 kV power line that would run past a middle school, a boys and girls club and homes with small children, according to Karen Adams, president of the new organization, ALERT (Alliance to Limit Electromagnetic Radiation Today). *People who live near the right-of-*way received no notification about the line, which is being built by Northeast Utilities, according to Adams. The company was sued a year and a half ago by two Guilford residents who claim that their brain tumors are due to EMFs from a power line and substation owned by the utility (see *MWN*, J/F92).

• *A plan to relocate the Children's Museum of* **Rhode Island** *has been* put on hold because of concerns about power lines at the proposed site, according to a May 18 article in the *Providence Journal-Bulletin*. Museum officials have begun to "back away" from the plan because of "concerns about the...EMFs generated by the 115 kV power lines," the article states.

New Publications from EPA

* ***Electric and Magnetic Fields: An EPA Perspective on Research Needs and Priorities for Improving Health Risk Assessment*** (Report No.EPA/600/9-91/016F), December 1992. This 56-page report from EPA's Office of Research and Development concludes that research on cancer, on biophysical mechanisms of interaction and on exposure assessment are top priorities for understanding EMF health effects. Research on the reproductive and nervous systems is assigned a medium priority, while research on immune system effects and control technologies is deemed a low priority. More specific recommendations are provided in the individual chapters of the report. When an earlier version of this document was released to members of the agency's Science Advisory Board in 1991, it drew sharp criticism for being broad and unfocused (see *MWN*, J/A91).

† ***EMF in Your Environment: Magnetic Field Measurements of Everyday Electrical Devices*** (Report No.402-R-92-008), December 1992. Published by EPA's Office of Radiation and Indoor Air, this 33-page booklet is a primer on sources of EMF exposures, with tables that list magnetic field levels from dozens of common appliances. The variation of EMF levels among different models of the same type of appliance is striking. For example, magnetic fields measured 6 inches away from various hair dryers ranged from 1 to 700 mG, according to the booklet; measurements taken one foot away from electric mixers ranged from 5 to 100 mG. The EPA does not directly address the question of whether EMFs are, in fact, a health risk. The authors state simply that, "We really don't know if typical, everyday exposures to EMFs affect human health." They also warn that the booklet's focus on field strength may turn out to be misguided: "Future research is likely to reveal that the information given in this publication is only part of the story—that is the chance we take in providing a public information document this early in the study of a complex environmental health issue." The data for the comparisons of EMF levels were drawn from three sources: the September 1992 Interim Report of EPRI's *Survey of Residential Magnetic Field Sources;* a 1984 report prepared by J. R. Gauger of the IIT Research Institute (IITRI) in Chicago; and measurements collected by EPA staff.

† ***Questions and Answers About Electric and Magnetic Fields*** (Report No.402-R-92-009), December 1992. This report is designed to "help EPA staff better understand and respond to questions from the public about electric and magnetic fields." The laundry list of questions includes: Are EMFs like X-rays? Why isn't the federal government setting a standard for EMF levels? What are cancer clusters? What is that metal electrical box on the corner of my lot?

* Available from: EPA, Office of Research and Development Publications Center, Cincinnati, OH 45268, (513) 569-7562.

† Single copies of these reports are available from: EPA, Information Access Branch, Public Information Center, 401 M Street, SW, PM-211B, Washington, DC 20460, (202) 260-7751.

EMF–Childhood Cancer Case *(continued from p.1)*

The Zuidemas sought compensatory damages of $136,000 to cover the cost of Mallory's past medical bills and $50,000 in losses they say they took on the sale of their house. They also asked for an unspecified amount for pain and suffering. The family moved from their San Diego home in 1990 after discovering magnetic fields of 4.5-20 mG. The house sits 15 feet from a 12 kV distribution line and 80 feet from the right-of-way for three 69 kV lines, one 138 kV line and one 230 kV line.

After deliberating for four hours, the jurors voted 11 to 1 that the evidence—as of 1987—linking magnetic fields and childhood cancer was speculative and that the utility therefore had not had a responsibility to warn its customers. The jurors were not asked to resolve the question of causation, because they had cleared the utility on the issue of negligence. They also found, by a 10 to 2 margin, that EMFs from SDG&E power lines did not pose a nuisance on the Zuidemas' property.

Aaron Simon of the Oakland, CA, firm of Kazan, McClain, Edises & Simon, who worked with Withey, explained that the trial turned on two questions: Was SDG&E negligent in failing to warn its customers about the potential health threats of EMFs by January 1987, when Mallory was conceived? And, did EMFs from the utility's power lines cause or promote Mallory's cancer?

During the trial, the Zuidemas' lawyers sought to prove SDG&E's negligence by showing that the utility had recognized that EMFs were a potential health threat. They pinned their argument on an August 21, 1986, report by John Dawsey of SDG&E's environmental affairs department, which concluded, in part: "Although it has not been convincingly demonstrated that either occupational or community exposure to 60 Hz electric or magnetic fields is associated with cancer, the possibility cannot be disregarded and should be seriously considered, given the present data."

According to Withey, "SDG&E had information, but didn't

Closing Arguments in Zuidema v. San Diego Gas & Electric Co.

Reprinted below are excerpts from the closing arguments in Zuidema v. San Diego Gas & Electric Co. (SDG&E). *The court reporter's transcript has been edited for length and clarity.*

Michael Withey, Esq., for Zuidema

After all is said and done, it comes down to basic human decency. We cover our mouth when we sneeze or cough, we tell our spouse or our coworkers I've got a cold, stay away from me. If we are aware of danger, possibility of harm, we warn people, watch out for that swinging door, look out for that pothole in the road. Simple human decency, good old-fashioned values. Caring for others....

So the heart and soul of this case after all the testimony, the blowups, the overheads, the scientific lectures, it all boils down to a simple question. What do you think SDG&E should have done in 1986 by the end of that year based on what they knew or should have known? If you think SDG&E officials should have said something to its customers to let [them] know about the potential risk of power line magnetic fields, then we ask your verdict for negligence and nuisance. But if you think what they did was fine, that's all you would expect from a company, that it was okay for them not to inform their customers about what they knew and had concluded, then your verdict should be for the defense....

It is...undisputed that SDG&E's top EMF scientist reviewed the literature—Mr. Dawsey—on power line [EMFs] and cancer, and he concluded that the possibility that 60 Hz [EMFs are] associated with cancer should be seriously considered and not disregard[ed]...

If Mr. Dawsey believed it should be taken seriously, is it unreasonable for this jury to believe yes, it should have been taken seriously[?]...So the question you have to ask is was it worth taking [the] risk of informing people, perhaps creating some alarm, in exchange alerting people to the nature of the risk, the consequences of which are enormous, as only the Zuidemas know so well....

Was EMF a substantial factor in [the] increase of...IGF-II, Insulin Growth Factor-II, and IGF-II receptors that all experts agree promote Wilms' tumor and nephroblastomatosis[?]...Now, if you find this to be the case, then your verdict should be for the plaintiffs, more probable than not, by a preponderance of the evidence....

And the evidence was also unrebutted that laboratory experiments conducted at the very outstanding Loma Linda University labs where Dr. Ross Adey works and Dr. John Fitzsimmons and Dr. David Baylink work...show the combined magnetic fields of low intensity and frequency...as low as 15 mG, increase both IGF-II and their receptors....

And we recall the testimony that [Mallory Zuidema's] exposure[s] at the 4 to 20 mG levels were higher than many of the exposures in the occupational studies which also showed an EMF cancer link...

What was the defense? First, no Wilms' tumors were shown in any studies. We've dealt with that. They weren't separated out, but they were here. Because the evidence as a whole support[s] that... power line magnetic fields promote childhood cancers....Secondly, the defendants say that Dr. Beckwith in his National Wilms' Study... has his pulse on Wilms' tumor, and that there is no evidence that power lines increase that risk....But [Dr. Beckwith]...never asked the question...whether they had lived close to power lines. And never gathered that data. That's what a scientist does, gather data. Not to have opinions based on data they haven't gathered...And then thirdly, the testimony was some vague, loose theory that because power consumption has gone up in the last 15 years, one would expect to see [more] Wilms' tumors and other cancers...Not a single defense witness testified to the key issue of whether increase in power consumption has actually increased the magnetic fields that people are exposed to in their houses....

Duncan Barr, Esq., for SDG&E

[T]his is a case really about common sense....

...I asked Mr. Withey, what...were the safety guidelines? And he told us 1,000 mG....The Zuidema home never got over 20 or 22....

...I believe it is very clear that there has never been anything presented to you to suggest that there is some kind of Wilms' tumor [EMF] connection....Dr. Beckwith told us...there was a higher incidence [of Wilms' tumors]...among African-Americans than there was among whites....But there was no difference if those people were in Africa or in the [U.S.]. Use your common sense. Where [are] the most [EMFs]?...He said there is no difference...in someone living in the middle of New York City or if they are living out on a farm. The incidence is still the same....If there was any relation with [EMFs] and Wilms' tumor, you would never find that kind of data. Never....

But the most important aspect of this, ladies and gentlemen...is when we have to warn....There is no duty to warn of potential health effects if it is based upon scientific and medical evidence which is speculative, conjectural or tentative....

...Not a single [epidemiological] study or word about 60 Hz and under 50 mG in magnetic fields, not one ever came to the conclusion that somehow or another there was this health risk....

We have...all of these depositions....They were taken all over the [U.S.]....Where is Dr. Savitz? Where is Wertheimer? Where is Leeper? Peters and London are in Los Angeles. Mr. Withey talked to you about Ross Adey...Where are they?...[T]he plaintiffs, even if [any of these people] wouldn't come here to testify, could have taken their deposition[s] under oath....

The Zuidemas didn't do anything wrong. They got drawn into this thing as unfortunately as anybody could be drawn into anything....If you believe...what...these lawyers are telling you—and...they have a very, very great interest in winning this case—if you believe what they are saying, then this is the worst conspiracy that this country has ever seen. It involves hundreds of public health agencies. It involves thousands of utility companies. It involves the World Health Organization. It involves hundreds, if not thousands, of universities. It involves thousands of scientists and medical doctors. It involves consumer organizations such as Ralph Nader and others. Because [none] of these entities...has ever suggested that there be a warning....

...It is what would the reasonable person, in this case, the reasonable utility company, knowing what it knew, having the information it had, what would it have done or not done. No one else in the world did this. And don't let Mr. Withey say this is the only people who had this information. All of his BEMS and BRAGS people had it....And not anyone anywhere has ever suggested that a Wilms' tumor was affected by [EMFs]. No one has come to the conclusion that is more than tentative or conjectural...that EMFs have something to do with health effects. The only people in the world that have suggested that are these three lawyers and [their] hired guns...

Use common sense. That's all I ask you to do. [SDG&E] is as much a part of this community as your police department, your fire department, your blood bank and your general hospital. It is a community asset. And if you are going to be asked to vilify them...to call them people who don't care about the death of small children, it needs to be done in a way and with evidence that is more powerful and more convincing than the scraps and bits and pieces that have been presented to you, and you should have heard from the people who wrote the studies if, in fact, these studies showed anything....

The Expert Witnesses and Their Fees*

For *Zuidema:*		
Abraham Liboff, PhD	Oakland University, Rochester, MI	$1,750/day
Bruce McLeod, PhD	Montana State University, Bozeman	$1,750/day
Samuel Milham, MD, PhD	Retired, Washington State Department of Health, Olympia	$1,500/day
David Ozonoff, MD	Boston University School of Public Health, Boston, MA	$400/hour
Wayne Spruce, MD	Children's Hospital, San Diego, CA	$500/hour
Peter Wright, MD	The Poly Clinic, Seattle, WA	$350/hour
For *SDG&E:*		
Bruce Beckwith, MD	Loma Linda University, Loma Linda, CA	$200/hour
Dan Bracken, PhD	T. Dan Bracken Inc., Portland, OR	$130/hour
John Graham, MD	Cedars-Sinai Medical Center, Los Angeles, CA	$350/hour
Seymour Grufferman, MD, PhD	University of Pittsburgh School of Medicine, Pittsburgh, PA	$350/hour
Robert Olsen, PhD	Washington State University, Pullman	$150/hour
Vikas Sukhatme, MD, PhD	Harvard University Medical School, Boston, MA	$225/hour

** The number of hours billed by each witness was not readily available.*

act on it. They have a duty to warn if they have information on potential risk." At the trial, Barr said that the utility did act on Dawsey's report by continuing to study the problem. He argues that, even today, the evidence linking power line EMFs and cancer is tentative. (For excerpts of the lawyers' closing arguments, see box at left.)

A separate but related dispute between Trial Lawyers for Public Justice (TLPJ) and the Electric Power Research Institute (EPRI) has been put on hold, according to Simon, who is a member of TLPJ. During the discovery phase of the Zuidema case, TLPJ asked for the release of documents that demonstrate that EPRI, which is funded by utilities including SDG&E, had tried to avoid sponsoring studies that would show an EMF health risk (see *MWN*, N/D92). As far as EPRI is concerned, however, the case is closed, according to spokeswoman Barbara Klein. Judge Ben Hamrick of Judicial Arbitration & Mediation Services Inc. in San Diego granted, with certain exceptions, EPRI's request for a protective order to shield its documents. Simon said that the issue would be pursued in future litigation—either by the Zuidemas, if they appeal, or in the next EMF case.

On the issue of whether EMFs from SDG&E's power lines had caused or promoted Mallory's cancer, Withey said that the Zuidemas' lawyers' "ability to argue causation depended largely on the admissibility of evidence on EMF health effects." California Superior Court Judge Judith Haller ruled that, according to her interpretation of state laws governing "hearsay," expert witnesses on both sides of the case could not discuss the conclusions of studies that were published after January 1987, except during cross-examination. Withey noted that many of the post-1987 studies—especially the 1992 Swedish reports (see *MWN*, S/O92)—are the most compelling in establishing an EMF–cancer link.

Dr. Abraham Liboff, a biophysicist at Oakland University in Rochester, MI, who testified on behalf of the Zuidemas, said that his "views on magnetic fields and cancer were never expressed properly at the trial because of the unique filtering process mandated by the judge."

But SDG&E's Barr said that he, too, was hurt by the judge's restrictive order, noting that his expert witnesses were not allowed to cite studies that refute an EMF–cancer association. He added that, even though jurors had not been asked to rule on the cause of Mallory's illness, "if they had determined for one minute that power lines had a role...they would have nailed us."

The Zuidema case was closely watched by lawyers across the country because it was the first EMF–cancer lawsuit to go to trial and it has the potential to set a precedent for future litigation. Tom Watson of the Washington firm of Crowell & Moring, which represents the vast majority of utilities in EMF cases, said in a telephone interview that he was not surprised by the jury's verdict and added that plaintiffs' lawyers "should take the ruling as a message."

Dixon Montague of the Houston firm of Vinson & Elkins also was not surprised by the decision, but he interpreted it differently: "The Zuidemas lost because they were confined to the facts available before 1987—not to what is known today." Montague won a lawsuit against Houston Lighting & Power in 1985, forcing the utility to remove a high voltage transmission line from school property at a cost of $8.6 million (see *MWN*, N/D85 and J/A88).

In a statement released after the trial, the Edison Electric Institute in Washington argued that, "The issue of whether there are adverse health effects from electric and magnetic fields should be resolved in the laboratory and not in the courtroom."

Lawyers for SDG&E predicted that the case will not change the way industry handles the problem of EMFs. "SDG&E will continue to [fund] EMF research, while communicating openly with its customers," said Greg Barnes, an SDG&E attorney. The utility is reported to have spent more than $2 million defending the Zuidema case, but Art Larson, a spokesman for the company, said that he could not confirm this amount. (A list of expert witnesses on both sides of the case and their fees appears above.)

But the Zuidemas' attorneys, who see the case as the beginning, rather than the end, of EMF personal injury litigation, said that the body of evidence linking EMFs and cancer is growing, and that it is only a matter of time before a jury finds it compelling. "The burden is on utilities now to prove there isn't an association [between EMFs and cancer] and the public is going to put them to the test," said Frederick Schenk of the San Diego firm of Casey, Gerry, Casey, Westbrook, Reed & Schenk, local counsel for the Zuidemas.

The Zuidemas have 60 days from the time Judge Haller enters the judgment to appeal.

enhancing the production of IGF-II with the application of EMFs in order to accelerate bone healing. Baylink is credited as the "inventor" on the EMF–IGF-II patent.

"If IGF-II is required for promotion of a tumor, then logically anything that increases IGF-II could lead to the promotion of that tumor," Dr. Robert Fitzsimmons, a member of Baylink's lab, said in an interview.

Dr. Vikas Sukhatme of Harvard Medical School in Boston, another of SDG&E's expert witnesses, told *Microwave News* that three factors undermine the EMF–IGF-II–Wilms' link: (1) kidney cells are very different from bone cells; (2) a 15.3 Hz signal is different from the fields associated with 60 Hz power lines; and (3) the EMF effect on IGF-II is relatively small—a twofold increase compared with the up-to-tenfold increase identified in patients with Wilms' tumors. Overall, Sukhatme said that he was "very, very skeptical" about the EMF link to Wilms: "To extrapolate from the data we have now is way out." He made similar points while testifying at the Zuidema trial.

Dr. Jim Ryaby, the director of research at OrthoLogic Corp. in Phoenix, which has the exclusive rights to Baylink's patent, is also skeptical: "The translation of findings in the bone system to any potential activation of abnormal cellular growth in other systems like the kidney is extremely speculative."

And Baylink himself feels there is little justification for the EMF–IGF-II–Wilms hypothesis. "It's a big jump to even suggest there is a cancer link," he said in an interview. Fitzsimmons is wary about extending his laboratory findings to environmental EMFs. "It's hard enough to get reproducible results under controlled conditions," he said.

On the other hand, Dr. Abe Liboff of Oakland University in Rochester, MI, who testified on behalf of the Zuidemas, believes that the IGF-II link has merit. "IGF-II not only plays a role in normal growth, but its overexpression has been linked by different investigators to a variety of different cancers, including brain and breast tumors," he said in an interview.

Liboff did not testify on the IGF-II link even though Fitzsimmons had tuned his exposure system to meet conditions of ICR, a technique Liboff has long championed for boosting biological activity. Dr. Peter Wright, a consultant for the Zuidemas, did address IGF-II on the witness stand, as well as IGF-II receptors. The receptors are important because, last year, Fitzsimmons presented a paper[3] in which he reported that 15.3 Hz fields could increase IGF-II receptors, without mentioning elevated IGF-II levels. The first direct reference to IGF-II appears in the March 1993 patent.

As Sukhatme explained under cross-examination at the Zuidema trial, IGF-II receptors and IGF-II "are two different molecules, two different genes, two different chromosomes. We're talking apples and oranges. One is the lock, one the key. The key is the IGF-II molecule, the lock is the IGF-II receptor."

When asked about the IGF-II results outlined in the patent, Aaron Simon, another attorney representing the Zuidemas, said: "Would this information about IGF-II have been helpful? Certainly. Would it have made a difference at the trial? I don't know."

1. A.E. Reeve et al., "Expression of Insulin-Like Growth Factor-II Transcripts in Wilms' Tumor," *Nature, 317,* pp.258-260, 1985, and J. Scott et al., "Insulin-Like Growth Factor-II Gene Expression in Wilms' Tumor and Embryonic Tissues," *ibid.*, pp.260-262.

2. *Method for Increased Production of Growth Factor in Living Tissue Using an Applied Fluctuating Magnetic Field,* U.S. Patent No.5,195,940, March 23, 1993.

3. R.J. Fitzsimmons et al., "EMF-Stimulation Increased IGF-II Receptors in Bone Cells," paper P-233, presented at the *First World Congress for Electricity and Magnetism in Biology and Medicine,* June 14-19, 1992, Lake Buena Vista, FL. Previously the group had reported an IGF-II effect induced by a capacitively coupled electric field, see: R.J. Fitzsimmons et al., "Low-Amplitude, Low-Frequency Electric Field-Stimulated Bone Cell Proliferation May in Part Be Mediated by Increased IGF-II Release," *Journal of Cellular Physiology, 150,* pp.84-89, 1992.

HIGHLIGHTS

MW Technician Awarded $2 Million in Default Judgment

A technician whose eyesight was damaged by microwave (MW) radiation from an illegal satellite transmitter has won a $2 million judgment—but collecting the money could prove difficult. The defendant in the case, Multicomm Telecommunications Inc., has declared bankruptcy, forcing attorneys for the injured technician to look to Multicomm's parent company, the Amway Corp., and its insurers for payment.

Keith Angstadt, an employee of Mutual Broadcasting System Inc., based in Arlington, VA, was injured on May 31, 1990, when, during the course of routine rooftop maintenance work, he was accidentally exposed to 6 GHz microwaves from a satellite uplink. Angstadt's lawyers filed suit, charging that Multicomm, located in Salt Lake City, and its president, Raymond Rask, who installed the device, were responsible for Angstadt's eye injuries (*see MWN,* N/D92). At the time of the incident, Rask was also a vice president of Amway.

On April 28, Arlington County Circuit Court Judge Benjamin Kendrick ruled that the defendants were liable, but the finding was by default because Rask had previously failed to show up for court dates and provide information Angstadt's lawyers had requested during discovery.

At a May 4 hearing on Angstadt's compensation, Kendrick granted him $350,000 in punitive damages—the maximum under Virginia law—and $1,650,000 in compensatory damages. Less than two weeks later, in an effort to collect the money, attorneys for the technician filed a claim against Amway, which is based in Ada, MI.

Angstadt's lawyers, Roy Mason and Natasha Wesker of the Baltimore firm of Mason, Ketterman & Morgan, told *Microwave News* that the May 4 hearing took place under "highly unusual" circumstances. They explained that the defendants' lawyer, John McGavin of the Fairfax, VA, firm of Lewis, Trichilo, Bancroft and McGavin, withdrew as counsel midway through the hearing, and that Rask did not return for the afternoon session, leaving no one to defend the suit. Kendrick made the damage awards after hearing about six hours of arguments from

Angstadt's lawyers, Mason said.

So far, representatives for Multicomm and Amway have remained silent. McGavin, who had represented Rask and Multicomm on behalf of Multicomm's insurer, the Atlantic Mutual Insurance Companies, headquartered in Madison, NJ, declined to comment, as did Bert Hultink, legal counsel for Amway.

In addition to the claim against Amway, which was filed on May 17 in federal court for the eastern district of Virginia, Mason and Wesker said that they also might file lawsuits against the National Union Fire Insurance Company of Pittsburgh and Atlantic Mutual, which sold policies to Amway in the amounts of $23 million and $1 million, respectively. Multicomm, as an Amway subsidiary, was covered by both policies, Mason charged.

In the original suit, filed on January 22, 1992, Angstadt's lawyers charged that Rask and Multicomm had "acted with reckless disregard for the safety of others" when they illegally converted a receiving antenna into a "dangerous" transmitter. They said that Rask had used a faulty waveguide, which caused "hazardous levels of microwave radiation to leak." Rask rigged the device after Multicomm was denied a permit by the Federal Communications Commission, which was concerned that the proposed antenna might interfere with the Pentagon's transmitting equipment.

Doctors at the Johns Hopkins University medical school's Wilmer Institute in Baltimore, who examined and treated Angstadt after the accident, determined that the retinas of his eyes had sustained 5 mW/cm^2 of continuous wave radiation for two 15-minute periods. They said that he had "suffered more microwave exposure than any human being ever studied by scientists," according to Mason. Angstadt is now color-blind and lacks night vision (see *MWN*, S/O91).

Expert witnesses who submitted depositions on Angstadt's behalf included: Dr. Burton Edelson of George Washington University in Washington, Dr. Stuart Fine of the Scheie Eye Institute in Philadelphia, David Janes of Risk Analysis in McLean, VA, and Mary Johnson and Henry Kues, both of the Wilmer Institute.

Dr. Bill Guy, a consultant based in Seattle, and Dr. Budd Appleton, a consultant in St. Paul, MN, had been scheduled to provide testimony for the defendants, Mason said.

Other defendants named in the original suit—including the landlord of the building where the accident occurred and the manufacturer of the equipment—were dropped from the case before the trial by Angstadt's lawyers because they "weren't really the culprits," Mason said. Amway had also been excused from the list but was named again in the recent collection efforts.

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NAS-NRC Finds GWEN Poses Minimal Public Health Risk

The U.S. Air Force's (USAF) Ground Wave Emergency Network (GWEN) poses a "minimal or nonexistent" public health risk, according to a new report by the National Research Council (NRC), an arm of the National Academy of Sciences (NAS) in Washington.

The NAS-NRC's GWEN committee, which was chaired by Dr. Thomas Tenforde of the Battelle Pacific Northwest Labs in Richland, WA, estimated that "the excess risk of cancer...associated with exposure to GWEN fields is less than one additional death over a 70-year period for persons living within 10 km of the entire system of GWEN sites."

The GWEN communications system is designed to withstand the electromagnetic pulse (EMP) from a nuclear explosion. If and when completed, it will consist of about 86 ground stations across the country operating at 150-175 kHz—each with a peak output power of approximately 2,000-3,200 W. In standby mode, the transmitters would only broadcast 1% of the time.

The committee took a novel approach to assess GWEN risks because there was too little data on radiofrequency (RF) radiation health effects to do a "traditional" assessment. The upper bound risk—3.6×10^{-6} excess cancer cases per year—was calculated by extrapolating from the "basically negative" reports among those living near radio and TV antennas. "Our working hypothesis was that the public health surveillance system would detect a doubling of background cancers if there was a cancer risk" from RF radiation, Tenforde told *Microwave News*.

Committee member Dr. Michael Ginevan, a biostatistician with Step Five Corp. in Washington, said that the twofold worst case risk estimate "seemed reasonable." He added that he and the two epidemiologists on the committee, Dr. Jan Stolwijk of Yale University in New Haven, CT, and Dr. Maureen Henderson of the Fred Hutchinson Cancer Research Center in Seattle, favored a range of 1.5 to 3.

Other epidemiologists told *Microwave News* that they were skeptical that the health surveillance system would detect a twofold excess in the absence of a detailed study. "I'm not sure what it would take, but the increase would have to be pretty obvious—say tenfold," said Dr. Raymond Neutra, the acting chief of the California Department of Health Services' Environmental Health Investigations Branch in Emeryville. "I've given a lot of thought to this issue because of the Sutro Tower situation," he added. A few years ago, elevated cancer rates were identified in San Francisco neighborhoods near the tower, from which the city's TV and FM radio stations broadcast (see *MWN*, M/A89). Similarly, Dr. Tim Aldrich, the director of North Carolina's Cancer Surveillance Unit in Raleigh, said that, "It takes a hefty increase to be picked up." He guessed that only a fivefold or greater excess would be routinely detected.

There are almost no epidemiological studies of people living in the shadow of radio and TV stations. Indeed, the committee noted that this lack of data is "surprising" and argued that such studies would be a good investment. One exception, a 1987 study by the Hawaii Department of Health that found higher than

expected rates of cancer among Honolulu residents living near broadcast towers (see *MWN*, M/J87), was discounted as "very weak" by the committee. Tenforde said that the committee had asked a number of European radio stations, broadcasting in the 154-234 kHz band, about possible health impacts and had not heard of any problems.

The GWEN risk assessment was quite controversial within the academy, and the release of the report was delayed for months. "Many more rounds of reviews were needed than first anticipated because of the approach taken in the risk chapter," said Dr. Keith Florig of Resources for the Future in Washington, who served on the committee. The delays were prompted by concerns that the report might imply a health risk from radio and TV antennas, according to knowledgeable sources. In a December 30, 1992, letter to the USAF, NRC Chairman Dr. Frank Press wrote: "We urge that readers keep in mind that the committee does not assign risk to exposure from commercial broadcast installations."

The NAS-NRC report was requested in 1990 by Reps. Lewis Payne (D-VA) and Les Aspin (D-WI); the USAF was barred from continuing to build the GWEN system until it was completed (see *MWN*, M/J90 and N/D90). Aspin is now Secretary of Defense and will decide the fate of the program. On March 31, 1993, Rep. Barney Frank (D-MA) introduced H.R.1555, which would force the secretary to terminate the GWEN system.

Last year, there were suspicions that GWEN signals were causing EMI (see *MWN*, N/D92). In 1987, the USAF issued draft and final environmental impact statements for GWEN (see *MWN*, M/J87 and N/D87).

Copies of the report, *Assessment of the Possible Health Effects of Ground Wave Emergency Network*, are available for $33.00 each, plus $4.00 for shipping, prepaid, from: National Academy Press, 2101 Constitution Ave., NW, Washington, DC 20418, (202) 334-3313 or (800) 624-6242.

Scientists Tackle Taos Hum

A low-frequency humming "sound" has been annoying many residents of Taos, NM, for more than two years. Some people who hear it complain that it causes headaches, sleeplessness and irritability. Others say they cannot hear it but can feel it. No one, it seems, knows what it is.

At the request of Rep. Bill Richardson (D-NM), a team of researchers—from the University of New Mexico (UNM) in Albuquerque and from Sandia National Laboratories, Los Alamos National Laboratory and Phillips Laboratory at Kirtland Air Force Base—has begun an intensive effort to identify the hum. In late May, eight of the scientists went to Taos in an attempt to measure or to record the phenomenon.

"So far, we have no best guess," explained Sherry Robinson, who edits *Quantum*, UNM's research magazine, and who accompanied the researchers to Taos. "We're still calling it a 'sound,' but that's mostly because no one knows what to call it," Robinson told *Microwave News*. In fact, sound waves have now been all but eliminated, she said. The researchers set up a sophisticated microphone where the hum could be detected, but they noticed nothing unusual. "We are left with electromagnetic radiation and seismic disturbances," Robinson said. The data collected are still being analyzed, and a preliminary report is expected by the end of June.

The team may have identified the frequency of the hum. Using a signal generator and a speaker, they re-created it for Bob and Catanya Saltzman, Taos residents who can hear the hum and who have accused the military of causing it. The researchers slowly lowered the frequency to find where it sounded the most like what the Saltzmans hear. At around 70 Hz, Catanya said, "That's it," according to Robinson. Bob picked 64 Hz. Another person who can hear the hum said that the re-creation sounded right at 32 Hz, which, Robinson noted, is a subharmonic of 64 Hz.

The Taos hum may not be unique. Similar complaints about low-level sounds have been investigated in the U.K. since the 1970s, members of the research team noted.

Press reports have suggested everything from equipment at the local sewage treatment plant to the Second Coming as possible explanations. *Newsweek* (May 3) raised the theory that slow movement along an earthquake fault could produce a steady, grinding hum. Other publications have cast suspicion on power lines and weapons testing. Bob Saltzman told the *Taos News* (February 25) that he suspects government experiments with infrasound used as a nonlethal weapon or as a way to track stealth aircraft.

Richardson was the first government official to point a finger at the military. At a February 22 town meeting in Taos, he said a Department of Defense (DOD) project—probably an Air Force project—was the likely source of the noise. In March, Sen. Pete Domenici (R-NM) asked Defense Secretary Les Aspin whether any DOD project could be responsible. John Deutch, an under secretary of defense, responded. "My staff has reviewed our defense activities in this area and has concluded there is no program, classified or not, which would cause this hum," Deutch wrote in an April 5 letter to Domenici. Deutch was no less unequivocal at a public briefing on May 12.

Richardson sticks by his accusation. "It is still appropriate to consider the federal government, particularly DOD and the Department of Energy, as suspects," said Richardson's press secretary, Stu Nagurka. He noted that Richardson had initially heard a rumor that a classified DOD project was responsible for the Taos hum and had asked the staff of the House intelligence committee, on which he serves, to investigate. "Some information reached the congressman that DOD is a likely culprit," Nagurka said, adding that several individual projects were raised as possibilities.

At the Taos town meeting, Richardson cited a radar testing facility at Kirtland Air Force Base and low-flying helicopters or airplanes as possible sources of the hum. Nagurka told *Microwave News* that other DOD projects are also candidates but that he could not provide any more details. *Newsweek* noted that the Navy uses extremely low frequency (ELF) radiation for submarine communications. One such system, known as Project ELF, operates at 72-80 Hz, with transmitters in Wisconsin and Michigan (see *MWN*, Mr84 and J/F90).

UNM's Robinson said that the investigation "is an earnest and good faith effort. The scientists involved consider it a personal and professional challenge." She maintained that no source had been ruled out. "DOD can't say 'It's not us,' when nobody knows what it is," she concluded.

COMMENTARY

The RF Problem

Non-ionizing electromagnetic radiations from radar, television transmitters, communication systems, microwave ovens, industrial heat treatment systems, medical diathermy units and many other sources permeate the modern environment. There is increasing anxiety that even at relatively low power densities, these radiations can affect biological organisms adversely. Since 1940 the growth in radiation sources has been phenomenal, and is continuing at an accelerated rate.

The EPA could have introduced its recent *Radiofrequency (RF) Radiation Conference*[1] with this warning. Actually, it was issued by a White House advisory committee, known as ERMAC,[2] more than 20 years ago in a call for a national research program on RF radiation risks. The research never was done and today we are paying the price.

If RF technology "permeated" the environment in 1971, how do we describe what is going on now? Back then, there were no cellular phones, no personal computers, no MRIs, and far fewer radars, microwave ovens and satellite uplinks. The wireless revolution will add to the RF smog as pocket phones proliferate and as computers and fax machines are fitted with radio transmitters.

Public anxiety has grown along with RF technology. Years of siting battles over broadcast antennas, cellular phone towers and weather radars—and the escalating power line controversy—have made EMFs and RF radiation the objects of a national phobia. Concerns over police radar and hand-held cellular phones are the latest to emerge.

Larry King showed how deep the fear runs when he put David Reynard on television and cellular phone health risks became front-page news from coast to coast. For the moment, Motorola and McCaw have dispelled fears of brain tumors with categorical, if insupportable, assurances of safety.

What must be done? Practically everybody at the EPA conference urged the adoption of an RF standard to counter public mistrust. Janet Healer of the National Telecommunications and Information Administration—a charter member of the ERMAC committee—put it most succinctly: "It's imperative for EPA to act; even something on a 3 by 5 'Post-It' would be helpful."

Most of those begging for a national standard are really asking the EPA to adopt the 1992 ANSI/IEEE RF guidelines. But Dr. Samuel Koslov, another member of the ERMAC committee, who recently retired from the Johns Hopkins University Applied Physics Lab, cast doubt on that approach. "The problem is that we are dealing with something we don't know much about," he said at the close of the first day of the conference. "The real issue is not whether EPA should set a standard, but whether EPA will produce the research that will allow for a standard."

The EPA has never endorsed the ANSI standard over the last 20 years. Marty Halper, director of EPA's radiation studies division, banned his staff from taking part in the most recent revision. "The group did not deal with all the data—specifically the nonthermal effects," he told us during a break at the conference. "As long as the public sees the ANSI/IEEE committee as being biased, its usefulness is limited," he said.

Clearly, some do see indications of bias. Dr. Mary Ellen O'Connor of the University of Tulsa, OK, president-elect of the Bioelectromagnetics Society and another ERMAC alumna, questioned the way certain papers that show health effects below the threshold deemed safe by the ANSI/IEEE committee were ignored: "Is it really because these studies have not been replicated? Is it really because the studies have not been published? Why is it that if a study falls below that [threshold], it is called 'interesting and in need of further work'?"

EPA's Dr. Joe Elder projected a list of six[3] of these "interesting" studies under the title "Unresolved Issues." They raise disquieting questions as to whether RF can affect cancer, pregnancy, vision and behavior. Most of these findings are years old, yet no one explained why they have not been repeated or refuted.

The reason is, as always, the lack of research funds. A good example of the sorry state of RF research is an Army investigation into the effects of lead poisoning on the reproductive health of artillery crews.[4] To the Army investigators' surprise, the control group selected for the study had lower sperm counts than those exposed to lead. It turned out that the controls had been exposed to RF at microwave frequencies. Thus, through blind luck, the Army did what practically no American had ever done: an RF epidemiological study, albeit a small one. The study passed unmentioned at the EPA conference—primarily because no one had heard of it.

Can a standard that leaves so many unanswered questions gain public credibility? It cannot, and therein lies the heart of the RF problem. The most potent criticism of the ANSI/IEEE standard is coming from the military. At last summer's World Congress, an Army colonel cast doubt on the adequacy of the standard. And more recently, an internecine feud has been brewing between two factions of the Air Force over the need to recognize nonthermal effects, which the ANSI/IEEE committee largely ignored in its guidelines. If the military can find fault with the standard, imagine what a motivated advocacy group could do with a little technical and legal expertise.

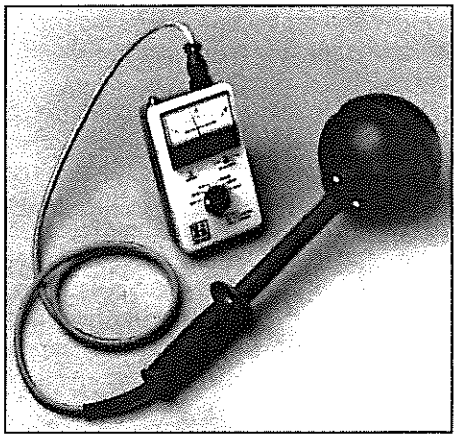
The cellular communications companies escaped serious harm last winter, but they and other RF users may not be so lucky the next time. And there will be a next time. The only way to quell the public's growing distrust is to answer the obvious question: What is a safe level of RF exposure?

1. Environmental Protection Agency (EPA), *Radiofrequency Radiation Conference*, April 26-27, 1993, Bethesda, MD. In this context, RF includes the microwave radiation band and covers 10 kHz-100 GHz.

2. Electromagnetic Radiation Management Advisory Council (ERMAC), *Program for Control of Electromagnetic Pollution of the Environment: The Assessment of Biological Hazards of Non-Ionizing Electromagnetic Radiation*, December 1971.

3. C.K. Chou et al., "Long-Term, Low-Level Microwave Irradiation of Rats," *Bioelectromagnetics, 13*, pp.469-496, 1992; H.A. Kues et al., "Increased Sensitivity of the Non-Human Primate Eye to Microwave Radiation Following Ophthalmic Drug Pretreatment," *Bioelectromagnetics, 13*, pp.379-393, 1992; H. Lai, "Research on the Neurological Effects of Non-Ionizing Radiation at the University of Washington," *Bioelectromagnetics, 13*, pp.513-526, 1992; L.G. Salford et al., "Permeability of the Blood-Brain Barrier Induced by 915 MHz Electromagnetic Radiation, Continuous Wave and Modulated at 8, 16, 50 and 200 Hz," *Bioelectrochemistry and Bioenergetics, 30*, pp.293-301, 1993; S. Szmigielski et al., "Accelerated Development of Spontaneous and Benzopyrene-Induced Skin Cancer in Mice Exposed to 2450 MHz Microwave Radiation," *Bioelectromagnetics, 3*, pp.179-191, 1982; S. Tofani, G. Agnesod and P. Ossola, "Effects of Continuous Low-Level Exposure to

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Radiofrequency Radiation on Intrauterine Development in Rats," *Health Physics, 51*, pp.489-499, 1986.

4. T. Weyandt, *Evaluation of Biological and Male Reproductive Function Responses to Potential Lead Exposures in 155 mm Howitzer Crewmen,* Fort Detrick, Frederick, MD: U.S. Army Biomedical Research & Development Laboratory, Technical Report 9124, 136 pp., January 1992.

UPDATES

COMPATIBILITY AND INTERFERENCE

Rethinking PEDs in Aircraft.. In mid-May, the largest U.S. carrier, American Airlines, finalized new rules that will prohibit passengers' use of all portable electronic devices (PEDs), including laptop computers and CD players, aboard aircraft that are below 10,000 feet. "This essentially covers takeoffs and landings," airline spokesman Tim Smith told *Microwave News*. In addition, the use of devices that are designed to transmit or receive signals—including cellular phones, AM and FM radios and portable televisions—will be prohibited at all times after a plane has left the gate. While this part of American's policy is not new, it had been "somewhat vague," Smith said. The new restrictions will be worked into the airline's operating procedures by July. Many airlines have been reexamining their policies on PEDs in the wake of press reports early this year about disruptions of airplane navigation and communications systems due to the in-flight use of PEDs (see *MWN*, M/A93). Meanwhile, a newly formed committee of the Radio Technical Commission for Aeronautics (RTCA), which is based in Washington, has begun the task of reevaluating the risk posed by EMI from PEDs. Since an earlier RTCA panel completed a thorough report on this issue in 1988, the new group, Special Committee (SC) 177, will focus on consumer electronics introduced in the last few years and will "determine testing criteria to be applied to PEDs so that they can be carried on board aircraft," according to the minutes of the group's first meeting. The panel will also consider newer aircraft technologies, such as electronic flight instrumentation, said SC177's chairman, John Sheehan of Phaneuf Associates Inc., an aviation consulting firm in Washington. Sheehan has been retained by the Cellular Telecommunications Industry Association to work for more liberal rules concerning cellular phone use aboard airplanes while on the ground. Frank White, chairman of the earlier RTCA committee, said that the proliferation of PEDs in the last five years justifies a new study. He pointed out, for example, that portable CD players—which have been mentioned often in the recent reports of airplane EMI—were just hitting the market when his panel completed its work. Harold Moses, RTCA's assistant technical director, added that, "The questions [about EMI] have persisted since the first report was issued." He also said that the FAA did not take up the earlier committee's recommendation that the use of PEDs not be allowed during takeoffs and landings (see *MWN*, N/D88). The FAA left the ultimate authority for regulating PEDs with the airlines—a responsibility they now say they do not want. American's Smith explained that the airline industry favors uniform rules on the use of PEDs. SC177 has met four times so far this year and is scheduled to have an interim report available for the FAA by October. A final report should be completed by mid-1994, Moses said.

EMP

Effects on Medical Devices... Many types of electronic medical equipment would be damaged by an EMP from a single nuclear bomb detonated more than 1,000 miles away, but most of these devices can be protected by taking simple precautions, according to two recent papers in *Military Medicine.* Commander Robert Vandre of the Walter Reed Army Medical Center in Washington, working with Janie Blanchard of Bechtel in San Francisco, Janis Klebers of JKL Associates in Springfield, VA, and Dr. Frederick Tesche, a consultant based in Dallas, tested seven different obsolete devices with pulses ranging from 10 kV/m to 100 kV/m at the Army's AESOP (Army EMP Simulator Operations) facility at the Harry Diamond Labs in Woodbridge, VA. At 100 kV/m, four units were immune, while an electrocardiograph failed—and an electrosurgical unit failed at 42 kV/m. A respirator exposed to 100 kV/m "would sigh once and then continue normal operation," according to the research team. But, when the devices were unplugged, they all escaped unscathed. The vulnerability of newer types of equipment, which have more electronic circuitry and are therefore at greater risk from EMI, was estimated with computer models. The researchers found that approximately 65% of 17 types of devices would be damaged or destroyed by a nuclear EMP. In a second paper, they outline specific measures, which, they argue, would allow approximately 88% of unplugged equipment to survive an EMP. In 1989, the American Medical Association recommended that EMP-resistant medical devices be developed (see *MWN,* J/A89). Vandre and coworkers' papers, "Electromagnetic Pulse (EMP), Part I: Effects on Field Medical Equipment," and "Part II: Field-Expedient Ways to Minimize Its Effects on Field Medical Treatment Facilities," appear in the April and May 1993 issues of *Military Medicine, 158,* pp.233-236 and pp.285-289, respectively. (For more on U.S. Army contracts on the effects of EMP on medical devices, see *MWN,* J/F86 and J/A87; for more on the effects of other types of EMI on medical devices, see *MWN,* N/D85, M/J88, S/O88, M/A90 and J/A91; for more on EMP safety at Army labs, see *MWN,* M/J90.)

INTERNATIONAL

Cancer Cluster in Sweden... Ten cases of cancer have been reported among employees at the mechanical engineers' building at Lund University in Lund, Sweden. Dr. Leif Floberg, a professor at the university, attributes the cluster to EMFs. Magnetic fields in the building's restaurant were as high as 400 mG, while EMFs in the library were 50 mG, Floberg told *Microwave News.* Maximum magnetic fields in lecture rooms and laboratories ranged between 8 and 46 mG. Floberg said that four of the ten people had died, and that, of these, three had been exposed to "high magnetic fields" from equipment that emitted EMFs—but, he added, there are no precise estimates for their exposures. More than 160 people work in the mechanical engineers' building. Floberg calculated that there should be one case of brain cancer every 60 years in the building; instead, there is one case each year. Power lines and electrical equipment in the basement of the building are the sources of the high EMFs, Floberg said. He recommended that this kind of electrical equipment be

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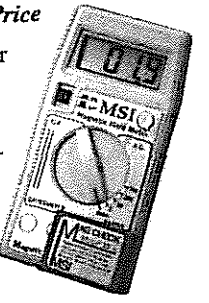


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"moved outdoors at an acceptable distance from the building." Last year, a Swedish electrical worker won a workers' compensation claim that attributed his brain tumor to on-the-job exposures to EMFs (see *MWN,* N/D92). Three cancer clusters among office workers have been under investigation in the U.S. (see *MWN,* M/A93).

MEETINGS

Circle of Friends... In 1990, a number of Bioelectromagnetics Society (BEMS) members who had become increasingly disenchanted with the organization's policies got together in an effort to make their opinions known. The group, which calls itself the "Circle of Friends," includes Drs. Eleanor Adair, David Erwin, Bill Guy and Martin Meltz. This year, the Circle of Friends is having its own meeting, complete with scientific sessions and social events, in Kalispell, MT, near Glacier National Park, on August 7-8. Adair told *Microwave News* that the group has no long-range plans and that—contrary to rumors that have been circulating—the meeting does not represent "a break with BEMS." She added: "I have no idea in the world that we will set up another society."

PEOPLE

Dr. **Genevieve Matanoski** has been named the chair of the EPA Science Advisory Board's Radiation Advisory Committee. Matanoski was the chair of the subcommittee that reviewed the EPA EMF and RF cancer report....Dr. **Larry Toburen** is the new staff officer of the National Academy of Sciences-National Research Council's (NAS-NRC) Board of Radiation Effects Research. He takes over from Dr. **Dennis Mahlum**, who has returned to the Battelle Pacific Northwest Labs in Richland, WA; Toburen comes to the NAS-NRC from Battelle....**Ron Petersen** of AT&T Bell Labs has been elected, and Dr. **Marvin Ziskin**, the director of Temple University's Center for Biomedical Physics, has been reelected, to the National Council of Radiation Protection and Measurements (NCRP)....Dr. **Sam Koslov** has retired from his post as the assistant director of the Johns Hopkins University Applied Physics Lab in Laurel, MD. ...After 17 years as a member of Dr. **Ross Adey**'s lab at the VA Hospital in Loma Linda, CA, Dr. **Asher Sheppard** has become a full-time consultant on EMF and RF issues; he is now based in Redlands, CA. Sheppard continues to be an associate editor of *Bioelectromagnetics*....**Frank Young**, formerly with EPRI, has joined Enertech Consultants in Campbell, CA, to manage research, instrumentation and software development, as well as the company's scientific consulting services.

RADAR

Florida ALS Cluster... In South Patrick Shores, the small Florida community where a Hodgkin's disease cluster was uncovered two years ago, eight people have developed amyotrophic lateral sclerosis (ALS). Rep. Jim Bacchus (D-FL) has asked federal officials to investigate the cluster and examine the possibility that a nearby air traffic control radar—which fell under suspicion when the Hodgkin's cases came to light (see *MWN,* J/F

92)—played a role. All eight people who developed ALS, which is commonly known as Lou Gehrig's disease, had lived within a few blocks of one another, at distances ranging from 3/4 of a mile to 2 miles from the radar, according to Marilyn Meyer, a reporter for *Florida Today*, a paper based near Melbourne. The cases date from 1980 to the present. In an April 4 special report, Meyer wrote about six people who had developed ALS, estimating that this was close to 17 times the expected number. Meyer then learned of two more cases in the neighborhood, which has about 2,000 residents. Her initial feature focused on drinking water contamination—the local water supply was known to have high levels of trihalomethanes in the late 1970s and early 1980s—and on other possible toxic chemical exposures. A subsequent article (May 20) discussed the radar. In response to Meyer's investigation, Bacchus asked the Agency for Toxic Substances and Disease Registry (ATSDR), part of the U.S. Public Health Service, to investigate. Bacchus's press secretary, Dan Sallick, told *Microwave News* that ATSDR will complete a "health consultation" soon. This will be a reexamination of information on possible environmental contaminants that was gathered when the Hodgkin's cluster was being investigated. According to ATSDR's final report on that investigation, completed in June 1992, there were also elevated rates of breast cancer and cervical cancer among women in the community. Further details were not provided, however, and the agency concluded that "the data do not indicate that humans are being exposed to levels of contamination that would be expected to cause adverse health effects." A full-blown "health assessment" of the ALS cluster will only be undertaken if something new comes to light, according to Mike Greenwell, a spokesman for ATSDR in Atlanta. Bacchus has asked the IEEE to suggest an expert on electromagnetic radiation health effects who could assess any radar risks, but, according to Sallick, whether the radar is in any way linked to these clusters "is a question we may not know the answer to for decades." ALS is a degenerative disease of the nervous system that has no known cause. A 1986 study found that the incidence of the disease was higher among people who worked in electrical occupations (see *MWN*, S/O86).

VDTs

EMF Report Shelved at OTA... The Congressional Office of Technology Assessment (OTA) has decided not to release a review of the possible health effects of VDT EMFs. The report, commissioned by the OTA in late 1991, was written by Dr. Indira Nair of Carnegie Mellon University (CMU) in Pittsburgh. It "is now on the back burner," Karen Bandy, a senior OTA analyst, told *Microwave News*. Bandy explained that Nair's report was going to be part of a larger OTA effort on computers and communications technologies, but that "it never quite worked out" and would now be used for "OTA background." In a telephone interview, Nair said that she was disappointed by OTA's decision, but that she plans to publish several papers on her findings. A 1989 OTA report on power frequency EMFs by Nair and her CMU colleagues was very influential in developing public policy—it popularized the concept of "prudent avoidance" (see *MWN*, J/A89).

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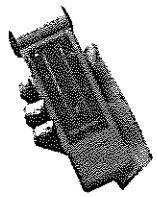
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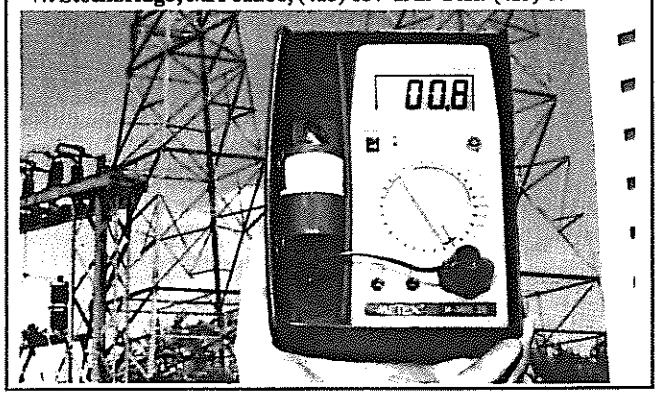
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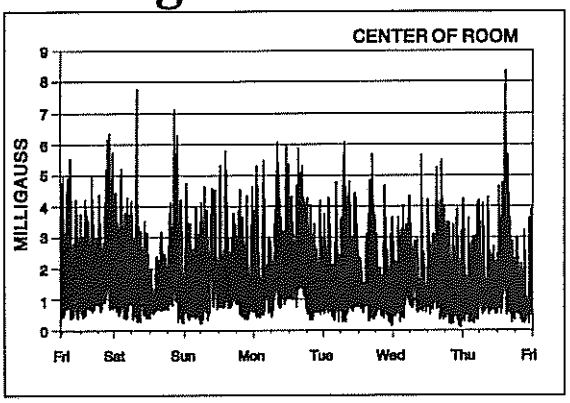
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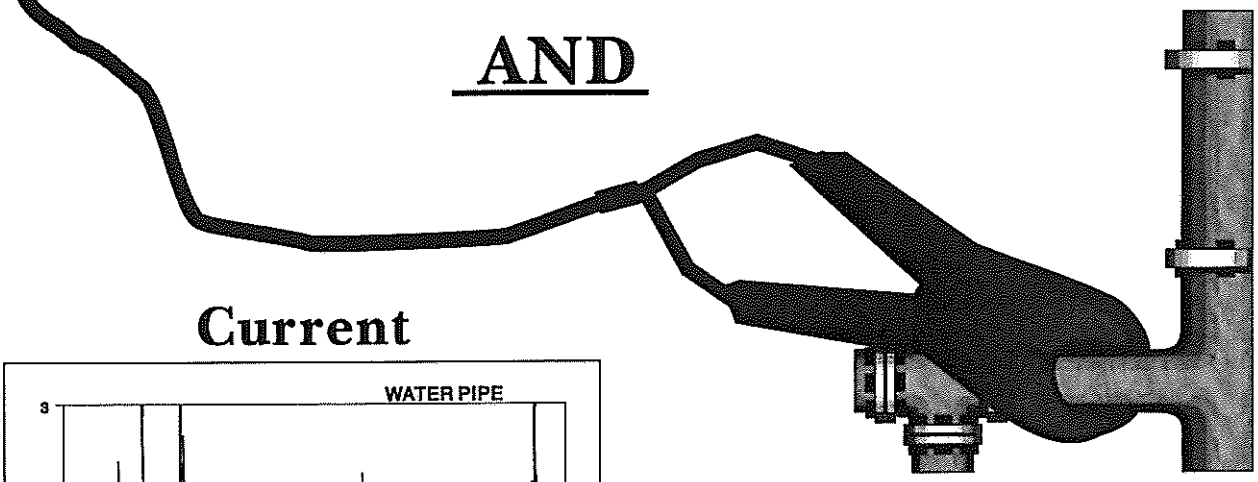


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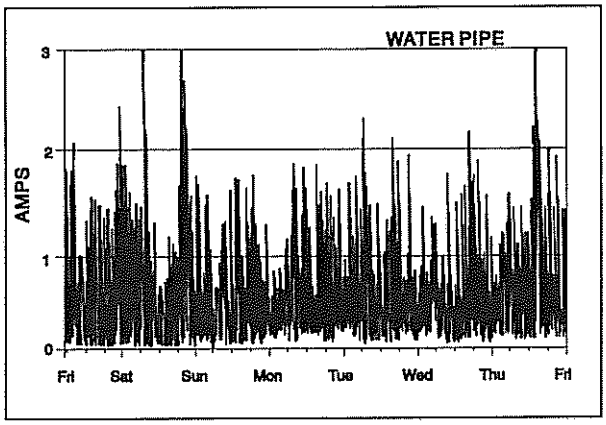
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