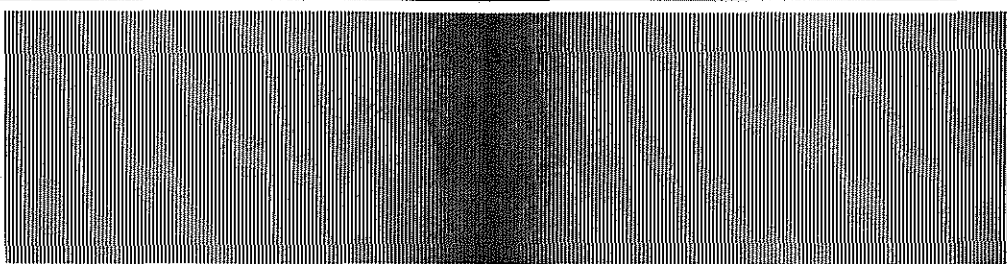


MICRO WAVE NEWS



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A Report on Non-Ionizing Radiation

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Toronto Power Line Meeting: Shifting Outlook on ELF Risks

Perceptions about the health risks associated with power lines are changing. Whether they believe the risks are real or imagined, utility managers now realize they can no longer dismiss the possibility that electromagnetic fields can cause biological effects.

"Utilities will be facing up to this issue more and more," Ontario Hydro's John O'Grady told *Microwave News* at the close of the *International Utility Symposium on the Health Effects of Electric and Magnetic Fields*. Even O'Grady, who spent two years organizing the meeting, was surprised by the large turnout: some 300 people came to Toronto, Canada, the week of September 16, almost double the number he had originally expected.

To be sure, some of the attendees remain convinced that power line fields are safe, but many had their confidence shaken when Dr. Richard Phillips told a jammed evening session that there is a real probability of a health hazard and that he would not buy a house along a power line right-of-way (see box on p.9). Phillips, who is now with the Environmental Protection Agency's Office of Research and Development, is best known for his studies on power line, or extremely low frequency (ELF), fields, carried out at the Battelle Pacific Northwest Labs in Richland, WA.

(continued on p.9)

Cancer Death Tied to AM Radiation in Spokane Lawsuit

A Spokane, WA, widower is suing a nearby AM radio station, alleging that his wife died as a result of overexposure to its broadcast radiation. In a complaint filed on July 30 in the Superior Court for Spokane County, Thomas DiLuzio charges that long-term exposure to KGA-AM's 50 kilowatt signal was responsible for his wife developing cancer. The suit also names the local school district and Spokane County as defendants.

Janice DiLuzio died at age 39 in 1982 of multiple myeloma, a cancerous proliferation of blood plasma cells that is similar to leukemia. Multiple myeloma usually strikes much older people; in the suit, DiLuzio contends that his wife's illness "is one of the, if not the, earliest reported cases of multiple myeloma in the United States."

John Glassman, DiLuzio's attorney, told *Microwave News* that the DiLuzios moved to their home, which is approximately 600 feet northwest of KGA's transmission tower, in 1972. Their children, now 15 and 12 years old, later attended the Mullan Road Elementary School, which is located less than 200 feet from the tower, on land purchased from KGA.

The DiLuzio suit also charges that the children were exposed to hazardous levels of radiofrequency (RF) radiation while attending the school, accusing both school and county officials of putting the school where they knew, or should have known, a hazard exists.

(continued on p.15)

Microwave-Induced Changes in Blood Barriers Related to Alzheimer's Disease and Corneal Effects

Microwave radiation may influence the development of Alzheimer's disease, according to Dr. Sam Koslov of the Johns Hopkins University Applied Physics Lab (JHU-APL) in Laurel, MD. Speaking at the Environmental Protection Agency's public meeting in Washington, DC, on September 22, Koslov said that a JHU-APL team had observed the telltale Alzheimer's pattern of neurofibrillary tangles in a monkey chronically exposed to microwaves.

Although unwilling to draw any conclusions based on only one experiment, he emphasized the finding's significance for understanding microwave bioeffects and as a possible primate model for studying Alzheimer's disease. (Researchers have long sought such a model.) Koslov said that he was reporting unconfirmed observations out of frustration over the lack of funding in microwave research.

In a wide-ranging presentation, Koslov hypothesized that the Alzheimer's tangles may be related to unintended leakage through the blood-brain barrier (BBB). He also suggested that a similar mechanism may explain the key findings of JHU-APL's Henry Kues that 2450 MHz radiation can disrupt the endothelial layer of the cornea in primates: this effect may be caused by a breakdown in the blood barrier in the eye, causing an increased production of free radicals. "You can see the blood vessels in the eye leaking following exposure to microwaves," he told *Microwave News* after the hearing (see story on opposite page).

According to Koslov's testimony, the brain cells of the monkey with the pattern of neurofibrillary tangles did not show the formation of plaques, another sign of Alzheimer's disease. Two other monkeys chronically exposed to 20-40 mW/cm² did not show any indications of Alzheimer's. Lack of funds has stymied the possibility of more experiments.

Samples of the microwave-exposed monkeys' cerebrospinal fluid (CSF) were sent to Dr. Hans-Arne Hansson at the University of Goteborg in Sweden, who has previously identified specific abnormal protein patterns in the CSF of radar workers (see *MWN*, May 1985). Koslov said that the monkeys' CSF showed protein bands that were closely related, though not identical, to those of the radar workers.

Earlier BBB Findings

At the 1981 meeting of the Bioelectromagnetics Society, Dr. Allan Frey of Randomline, Inc., reported that pulsed 1.2 GHz microwaves could affect the blood-vitreous humor barrier in the eyes of rats. At the time, Frey, who is based in Huntingdon Valley, PA, said that more research was needed to elucidate "what is happening and why."

In 1975, Frey was the first to report that microwaves can alter the permeability of the BBB (*Annals of the New York Academy of Sciences*, 247, pp.433-439, 1975). Following a 1977 paper by two army researchers, Drs. Kenneth Oscar and Daryl Hawkins, showing that pulsed 1.3 GHz radiation at power levels as low as 30 μ W/cm² affected the BBB (*Brain Research*, 126, pp.281-293, 1977), the problem became a hot research topic. A number of conflicting reports appeared, but soon afterwards, funding dried up and work stopped,

leaving many questions unanswered.

The decision to stop research on the effects of microwave radiation on the permeability of the BBB was strongly influenced by the Department of Defense, according to Dr. Nicholas Steneck, a historian at the University of Michigan, in his book, *The Microwave Debate* (Cambridge, MA: MIT Press, 1984).

BBB Work Should Have Continued

In an interview following the EPA hearing, Koslov said that BBB work "should not have been abandoned." He added that the JHU-APL researchers were now exposing monkeys to microwaves to monitor leakage through the BBB. Before joining JHU-APL, Koslov was a senior Navy advisor. He is a member of the Frequency Management Advisory Council (FMAC) at the National Telecommunications and Information Administration.

Although Koslov's presentation is the first to publicly associate microwave exposure to Alzheimer's disease, the possibility was raised years ago in the case of Samuel Yannon, a former New York Telephone technician, who died in 1974 after having worked on microwave relay equipment on the 87th floor of the Empire State Building for 15 years. His doctor diagnosed Yannon's condition as "chronic brain syndrome with psychotic overtones due to biological brain changes resulting from prolonged exposure to short wave radiation." In its defense, New York Telephone argued that Yannon suffered from pre-senile dementia, probably Alzheimer's disease (see *MWN*, April 1981).

EPA Closes Bioeffects Lab

The Environmental Protection Agency's (EPA) non-ionizing radiation research program has been closed down. After waging a four-year battle against their own senior management, EPA staffers in Research Triangle Park, NC, have conceded — all bioeffects research has now stopped.

"We're dead in the water," Dr. Richard Phillips told *Microwave News* in an interview. Phillips left the Battelle Pacific Northwest Labs two years ago to take over EPA's non-ionizing radiation effort, only to spend most of his time trying to keep the program alive. Phillips said that he is still trying to secure some funds so that Dr. Carl Blackman can continue his studies on the role of the Earth's magnetic field on electromagnetic interactions. Phillips called Blackman's calcium work "critically important."

Most of the researchers who used to work on radiation are now studying problems associated with toxic chemicals (see also *MWN*, January/February 1983, September/October 1985 and January/February 1986).

Florida Power Line Award Appealed to State Supreme Court

Florida Power & Light Co. (FP&L) has asked the state Supreme Court to overturn a \$1.6 million award to owners of land adjacent to lots condemned for a 500 kV power line right-of-way. The 1985 award, which was upheld by an appeals court in April, was based on the jury's opinion that power line radiation poses a potential health risk, resulting in lower property values nearby.

In the appeals court decision issued on April 4, 1986, in a suit originally brought by S. Bryan Jennings, Jr., and co-plaintiffs, the presiding judges supported the lower court's decision to include expert testimony on health risks at the trial. They found that there is a "reasonable basis" for residents to fear the health hazards posed by power line radiation and to seek compensation for losses in land value. FP&L had contended that the testimony should have been excluded.

In a second, virtually identical, case, an appeals court ruling handed down on June 5 agreed with the April 4 Jennings decision and affirmed a \$1.8 million award to Virginia S. Roberts and co-plaintiffs.

The two cases stem from FP&L's 1983 condemnation of land for a power line. Because the lots fell in two different counties, the cases were tried separately.

Theresa Rooney, a lawyer associated with Jacksonville attorney David Foerster, who is representing the landowners in both suits, told *Microwave News* that the utility could have combined the cases on appeal to the Supreme Court; she said that the outcome of the Jennings appeal will apply to the Roberts case.

Barry Davidson of the Miami firm of Steel, Hector & Davis is representing FP&L in conjunction with Carlos Alvarez, who specializes in electromagnetic radiation cases for the Tallahassee firm of Hopping, Boyd, Green & Sams. Speaking at the International Utility Symposium in Toronto in mid-September, Alvarez said that he expects the Supreme Court to hand down a decision in the spring of 1987.

In its brief to the Supreme Court, FP&L argued that the trial and appeals courts erred in permitting expert testimony regarding the health effects of power lines. The utility contended that "such evidence has no relevance and serves only to inflame and improperly prejudice a jury, given the nature of such evidence, which suggests, among other things, that living near transmission lines, or even distribution lines, may 'promote' cancer."

In a telephone interview, Alvarez said that in both the Jennings and Roberts cases, the health risks testimony was used to persuade the juries to increase the amount of the condemnation awards. He maintained that courts should rely solely on real estate assessments to determine settlements. In both the Jennings and Roberts trials, FP&L attorneys argued that evidence suggesting a link between power line siting and land market values was only speculative.

Trial Witnesses

Drs. Nancy Wertheimer and John Norgard, both of the University of Colorado, testified for both sets of land-

owners. Wertheimer told the jury that "there [is] a relationship between adverse health effects and the electromagnetic field," according to the owners' brief filed in response to FP&L's Supreme Court appeal. Norgard, a professor of electrical engineering, described the field distribution of power line radiation and concluded that humans could not live safely within 440 feet of a 500 kV line.

Dr. Morton Miller of the University of Rochester Medical School testified for FP&L that adverse health effects from the power line are extremely unlikely.

Attorney Rooney also submitted several reports from neighboring towns, which showed that property values near power lines were lower than those elsewhere.

The citations for the decisions in the Florida District Courts of Appeal are: Florida Power & Light Co. v. S.B. Jennings a/k/a S. Bryan Jennings, Jr., et al. [485 So.2d 1374 (Fla. App. 1 Dist. 1986)], opinion filed April 4, 1986, and Florida Power & Light Co. v. Virginia S. Roberts, et al. [490 So.2d 969 (Fla. App. 5 Dist. 1986)], opinion filed June 5, 1986.

Industry Urges EPA To Set RF/MW Safety Standard

Business users of radiofrequency and microwave (RF/MW) radiation urged the Environmental Protection Agency (EPA) to set an exposure standard for the general public, at a public meeting in Washington, DC, on September 22. The message was clear: the specific limit is less important than the need for a national standard.

Richard Ekfelt, the executive director of the Electromagnetic Energy Policy Alliance (EEPA), expressed "strong opposition" to federal inaction. "A federal standard is sorely needed by the public and by industry," he told EPA.

Similarly, Ralph Justus of the National Association of Broadcasters (NAB) stated that he "vigorously" opposed the EPA's non-regulatory option. It would be the "most harmful option," he said, adding that the costs associated with the other three options "pale" in comparison with that of not setting a standard. Justus conceded that it is "a peculiar situation" in which industry is asking for regulation but, he said, it is "absolutely necessary," given the proliferation of local RF/MW rules.

EPA held the meeting to hear responses to its four proposed options for limiting public exposures to RF/MW radiation (see *MWN*, July/August 1986). Although the options are cited in terms of specific absorption rates (SARs), they are equivalent to power density levels of 100, 200 and 1,000 uW/cm²; the fourth option is to not set a standard. EPA does not have the authority to set a national exposure standard; instead, the agency is proposing to issue a guidance which, when approved by the President, would apply to all other federal agencies.

Despite the growing public interest in the health effects of RF/MW radiation, only a dozen people spoke at the hearing — three of whom represented NAB. Approximately 40 people attended the hearing.

Both Ekfelt and Justus, as well as Arthur Varanelli of Raytheon, favored a federal standard that would preempt

Zapping at Greenham Common?

Women protesting the deployment of cruise missiles at the U.S. Air Force base at Greenham Common in southwest England claim they are being exposed to non-ionizing radiation in order to force them to abandon their peace camp.

Kim Besly, the coordinator of the "zapping" investigation at Greenham, blames the radiation for a large array of symptoms reported by the women: disturbances in menstrual cycles and sleeping patterns; irregular heartbeats; head, chest and ear pains; anxiety and nausea. One woman said that she got a sunburn during the night.

Besly told *Microwave News* that women identified radiation as the most probable cause of the ailments by a process of elimination: checks of food and water failed to indicate any contamination. She said that military and civilian officials "have tried every way to move us away since the camp was set up more than five years ago."

Many people in the U.K. discount the possibility of a radiation problem, saying that the symptoms are those of "hysterical" women who are living out in the open without proper food and shelter.

Besly has begun a medical project to document the health problems: All visitors are being asked to keep diaries of any ailments they develop while at the camp, and doctors and nurses are being recruited to examine those women with serious medical complaints.

Besly has asked the U.K.'s National Radiological Protection Board (NRPB) for help in measuring the radiation levels, but without success. In an interview, Frank Cook, a Member of Parliament, said that he

had also asked John Dunster, the director of NRPB, to lend the women power density meters but was turned down.

NRPB's Alastair McKinlay told *Microwave News* that the board has volunteered its services to local government officials but that they have not replied. Many of the residents in the nearby village of Newbury are unsympathetic to the Greenham women's politics and want them to abandon the peace camp — making a request to the NRPB unlikely.

Allegations of "zapping" at Greenham began to circulate two years ago and have been extensively covered by small circulation, peace-oriented publications, but have been largely ignored by the mainstream media. In the last few months, the Greenham women have mounted a more concerted effort to bring attention to the radiation problem. The women say that they do not know whether they are being exposed to the radiation deliberately or unintentionally, perhaps by a communication or radar system at the base.

Over the years, there has been speculation about the use of non-ionizing radiation to affect behavior. The most famous example involved the possible motives for the beaming of microwaves at the U.S. embassy in Moscow from the 1950s through the 1970s.

Extensive interviews by *Microwave News* with knowledgeable U.S. government experts indicate that radiation-based technology for manipulating crowds is feasible, and could be available soon, if it is not now. All of those interviewed said that they did not believe that the U.S. government is using such electromagnetic weapons at Greenham Common.

state and local limits.

Ann Hagemann of the Association of Maximum Service Telecasters (AMST) said that it is "unacceptable" for EPA not to set a guidance. And AT&T's Kelly Kollios, representing Bell Labs' Dr. Max Weiss and Ron Peterson, "urged EPA to disregard Option 4," to reduce the costs incurred by having to comply with conflicting state and local ordinances.

Non-business speakers were not unanimous in their conviction that EPA has the necessary information to set a standard, but they all endorsed the need for more research on the biological effects of non-ionizing radiation. Elise Kreindler of Citizens Against the Tower in Vernon, NJ, said that "the setting of any standard can only serve to benefit the industry," arguing instead that EPA should reactivate its bioeffects research program. Regina Siberski of Newtown Square, PA, asked EPA to set an "interim standard" while reinstating the EPA research effort in North Carolina (see box on p.2).

Aside from asking for a federal standard, most of the speakers were not specific as to desired limits. AT&T's Kollios was the most direct, endorsing 200 uW/cm² (option

2), while Raytheon's Varanelli said that 1,000 uW/cm² (option 3) is "sufficient" and that EPA's limits should not be more stringent than 200 uW/cm².

Dr. Sam Koslov of the Johns Hopkins University Applied Physics Lab (JHU-APL), speaking for himself, said that he favors a 100 uW/cm² limit — the standard already adopted by JHU-APL (see *MWN*, December 1984) — and that he is willing to tolerate 200 uW/cm², but nothing higher.

The NAB representatives and EEPA's Richard Ekfelt said that they were still analyzing the options and would submit additional comments to EPA by the October 28 deadline. AMST's Hagemann said that she too was still reviewing the data, though at present she favors the ANSI standard.

In an extended presentation, Dr. Marjorie Lundquist of the Industrial Hygiene Institute in Milwaukee, WI, said that EPA should be treating the results of the Guy long-term exposure study more seriously and that the results suggesting a link to cancer cannot be discounted because of the low incidence of cancer among the control rats (see *MWN*, March 1985). Researchers cannot set aside the results and use historical controls because they don't like the outcome, she said.

Pulsed Radiation More Harmful Than CW to Rats' Lenses

Pulsed microwave radiation can cause approximately five times more damage to the lens of the eye than can continuous wave (CW) radiation at the same average power level, according to the results of recent experiments on isolated rats' lenses at the Walter Reed Army Institute of Research (WRAIR) in Washington, DC, in a collaboration with the University of Western Ontario in London, Canada.

Dr. John Trevithick of the university's Department of Biochemistry measured radiation damage by studying changes in the lenses' cell membranes. Pulsed 918 MHz microwaves disrupted the membranes — thereby initiating the disintegration of cells — more effectively than did CW radiation.

In a poster paper presented at the Bioelectromagnetics Society meeting in Madison, WI, in June, Trevithick reported that an empirical model based on the experimental data showed that pulsed microwaves "caused 4.7 times the depth of damage as CW at the same average power."

Trevithick told *Microwave News* that, at this time, he "cannot make any inferences about *in vivo* damage" based on the present *in vitro* results.

This is the first demonstration of an increased biological efficacy of pulsed radiation compared to CW for the lens of the eye, although Henry Kues and coworkers at the Johns Hopkins University Applied Physics Lab (JHU-APL) in Laurel, MD, have reported that pulsed 2.45 GHz radiation at a specific absorption rate (SAR) of 2.6 W/Kg could cause

Glaucoma Treatment Potentiates MW Effect

People who use topical drugs for glaucoma are at increased risk of eye damage from exposure to microwave radiation, according to Dr. Sam Koslov of the Johns Hopkins University Applied Physics Lab in Laurel, MD.

In remarks made at an Environmental Protection Agency hearing on September 22, Koslov said that JHU-APL's Henry Kues and coworkers had found that pulsed microwaves at an average power level of 5 mW/cm² caused cell death in the endothelial layer of the corneas of experimental monkeys, whose eyes had been treated with pilocarpine or similar glaucoma drugs. The corneas of untreated monkeys were affected at 10 mW/cm².

Koslov warned that, due to lack of funds, the experiments have not been completed, and any threshold for the effect — with and without drug-microwave synergy — has still to be determined. The work, which was paid for by the Office of Naval Research, will be published soon, Koslov said.

Microwaves have previously been found to potentiate the action of a number of drugs, including the tranquilizer Librium (see *MWN*, February 1981).

abnormalities in the corneal endothelium of monkeys *in vivo* similar to those caused by CW radiation at an SAR of 5.3-7.8 W/Kg (see *Bioelectromagnetics*, 6, pp.177-188, 1985, and *MWN*, July/August 1983). Recent work by the JHU-APL team indicates that people taking glaucoma medication may be at increased risk of microwave injury (see box below).

Numerous earlier studies have shown a similar effect for other end points: in 1977, Dr. Elliot Postow of the Naval Medical R&D Command in Bethesda, MD, identified more than 20 examples of the greater efficacy of pulsed microwaves at frequencies between 1 and 12 GHz (see *The Biological Effects of Radiofrequency and Microwave Radiation*, by H.M. Assenheim et al., National Research Council of Canada, No. 16448, 1979). Postow told *Microwave News* that an updated version of the table will appear in the forthcoming *CRC Handbook of Biological Effects of Electromagnetic Fields*.

Temperature Changes

Although the lenses absorbed relatively large amounts of energy during the radiation exposure — 6-60 minutes at power densities with SARs of 23 to 750 W/Kg — they were maintained at 37°C by a circulating water bath. Trevithick said that recent, preliminary experiments with a Luxtron temperature probe showed that the resulting temperature increases were less than half a degree C.

The question of how fast heat is transferred during experiments of this type has been disputed. See, for instance, the exchange between Dr. Kenneth Foster and coworkers at the University of Pennsylvania and T.C. Guo and W.W. Guo of the JHU-APL and coworkers at WRAIR in *IEEE Transactions on Microwave Theory and Techniques*, August 1982 and September 1983.

Work with Millimeter Waves Next

Trevithick recently started a series of *in vivo* experiments, under a \$194,000, three-year grant from the U.S. Army Medical R&D Command. In a continuing collaboration with WRAIR, he will expose the corneas of anesthetized rabbits' eyes to 35 GHz millimeter waves.

See also the research team's earlier paper, "In Vitro Studies of Microwave-Induced Cataract: Reciprocity Between Exposure Duration and Dose Rate for Pulsed Microwaves," *Experimental Eye Research*, 40, pp.1-13, 1985.

FCC Asked To Guard Against EMP

Two individuals have asked the Federal Communications Commission (FCC) to study how the U.S. civilian economy could be protected from an electromagnetic pulse (EMP) generated by a high-altitude nuclear explosion. On July 30, Nikolaus Leggett and Donald Schellhardt petitioned the FCC to open a "Notice of Inquiry" (NOI) for possibly requiring the shielding of civilian communications against EMP.

Leggett, a technology analyst, and Schellhardt, an attorney, argue that "EMP has become the last word in economic warfare" and that not enough attention has been paid to the threat to the civilian sector.

Electromagnetics LAP: Accredited Labs

The National Bureau of Standards (NBS) has accredited 14 laboratories for electromagnetic compatibility (EMC) and telecommunications testing under the bureau's National Voluntary Laboratory Accreditation Program (NVLAP). The new EMC NVLAP is intended to ensure that foreign nations accept test data from accredited labs and to help standardize domestic EMC testing procedures.

NBS set up the EMC LAP last year in response to a petition from Walter Poggi, president of Retlif, Inc., in Ronkonkoma, NY, and from four other testing labs (see *MWN*, March, June and September/October 1985 and March/April 1986). The program covers test methods for conducted emissions, radiated emissions and terminal equipment compatibility, all using pro-

cedures devised under Parts 15J and 68 of the Federal Communications Commission's (FCC) rules. Military and foreign test methods may be added later, according to NBS.

FCC staffers, who oversee U.S. EMC policies, have not yet said that they will recognize the new LAP, and some observers are asking whether the program can be effective without FCC support. *Microwave News* will report on the FCC's involvement in the EMC LAP in a future issue.

The 14 accredited labs, together with contacts, are listed below. For more information, contact Jeffrey Horlick, NVLAP, NBS, Admin A531, Gaithersburg, MD 20899, (301) 921-3431.

Amador Corp.
Wild Mountain Rd.
Almelund, MN 55002
(612) 583-3322
Daniel D. Hoolihan

AT&T Information Systems:
EMC Laboratory
M/S: Building 41-112
Crawfords Corner Rd.
Holmdel, NJ 07733
(201) 834-1801
Don N. Heirman

Communication Certification Laboratory
1940 West Alexander St.
Salt Lake City, UT 84119
(801) 972-6146
William S. Hurst

Continental Testing Laboratories
8385 South U.S. Highway 17-92
Fern Park, FL 32730
(305) 831-2700
Joe Sini

D.L.S. Electronic Systems, Inc.
10350 Dearlove Rd.
Glenview, IL 60025
(312) 699-9060
Donald L. Sweeney

Dash, Straus & Goodhue, Inc.
593 Massachusetts Ave.
Boxborough, MA 01719
(617) 263-2662
Glen Dash

Elite Electronic Engineering Co.
1516 Center Circle
Downers Grove, IL 60515
(312) 495-9770
James C. Klouda

EMACO, Inc.
7562 Trade St.
San Diego, CA 92121
(619) 578-1480
Herbert K. Mertel

GTE Evaluation & Support Dept.
3050 Harrodsburg Rd.
Lexington, KY 40503
(606) 223-3061
Clifford Eugene Jones

MET Electrical Testing Co., Inc.
916 West Patapsco Ave.
Baltimore, MD 21230
(301) 354-2200
Robert D. Johnson

Norand EMC Test Laboratory
104 Cemetery Rd.
Fairfax, IA 52228
(319) 369-3539
Michael W. Howard

Retlif, Inc. Testing Laboratories
795 Marconi Ave.
Ronkonkoma, NY 11779
(516) 737-1500
Walter A. Poggi

R&B Enterprises
20 Clipper Rd.
West Conshohocken, PA 19428
(215) 825-1960
Finbarr M. O'Connor

Underwriters Laboratories, Inc.
1285 Walt Whitman Rd.
Melville, NY 11747
(516) 271-6200
Louis Okin

"We are trying to correct the oversight of dealing only with the EMP risk to the military," Schellhardt told *Microwave News* in a telephone interview. "The EMP threat exists outside a full-blown nuclear war," he added, "because any country that can get hold of one nuclear weapon and one delivery vehicle could stage an EMP attack."

Schellhardt stressed that neither he nor Leggett acted on behalf of an organization: they filed the petition as private citizens because "we got tired of watching the evidence pile up while no one in authority took any meaningful action." He said that they felt that filing the petition was "mildly patriotic."

GTE Responds

On September 11, GTE Service Corp. filed comments on the petition, arguing that no FCC action is needed. Daniel Bart, a GTE attorney based in Washington, DC, acknowledged that, while Schellhardt and Leggett had made "some valid points," they nevertheless "appear to be uninformed" about ongoing efforts to address the EMP threat. Bart noted that the American National Standards Institute's (ANSI) T-1 Telecommunications Standards Committee is developing EMP standards.

The ANSI EMP effort grew out of a recommendation by the EMP Task Force of the President's National Security

Telecommunications Advisory Committee (NSTAC) to take steps to protect the public telephone network from a high altitude EMP (see *MWN*, June 1985).

On September 24, Schellhardt and Leggett replied that the NSTAC and ANSI efforts are insufficient because they both "fail to guarantee a voice for the general public" and "fail to guarantee consideration of the public interest." Schellhardt and Leggett also argued that ANSI's focus on telephones alone is insufficient. They again urged the FCC to address the EMP problem.

The FCC does not have a time limit for responding to the petition, but must act within a "reasonable" period of time.

For more information, contact: Nickolaus Leggett, Apt. 610, 1500 Massachusetts Ave., NW, Washington, DC 20005, (202) 223-8689, or Donald Schellhardt, Apt. 202, 6062 Edsall Rd., Alexandria, VA 22304, (703) 370-9067. And GTE's Daniel Bart, Suite 1200, 1850 M Street, NW, Washington, DC 20036, (202) 463-5212.

U.K.'s NRPB ELF, RF & MW Radiation Standards Criticized

The United Kingdom's National Radiological Protection Board's (NRPB) proposed standard for frequencies below 300 GHz is receiving generally unfavorable reviews from the non-ionizing radiation community. The proposal, which recommends limits for workers and the general public, has been criticized as too complex and poorly reasoned.

The 17-page document specifies one set of standards for workers and two different (short-term and long-term) sets of standards for the public. Some of the limits also can be adjusted for different exposure times. The three sets of limits are hard to compare because each is divided into different frequency ranges. For example, for extremely low frequencies up to 10 MHz, the short-term population standard is divided into eight frequency ranges, while the other two standards are each divided into six ranges — to complicate matters further, the latter two sets of frequency ranges are not the same.

According to the NRPB's "explanatory notes" that accompany the proposed standards, the board adopted a 0.4 W/Kg limit for radiofrequency and microwave frequencies. Nevertheless, the NRPB specifies an 80 uW/cm² standard for the general public from 10 to 300 MHz, a level much stricter than other standard-setting bodies have adopted based on the same 0.4 W/Kg limit. The 80 uW/cm² level would apply for continuous exposures in residential areas. The NRPB states that below 80 uW/cm² it would be "unnecessary to consider occupancy and shielding factors."

The NRPB notes that, although the evidence for the carcinogenic and mutagenic effects due to electromagnetic fields is "extremely weak," exposures "should be kept as low as reasonably practicable" until the possibility of such effects can be eliminated "beyond reasonable doubt."

"Too Complicated"

In interviews at the International Utility Symposium in Toronto in mid-September (see p.1), power line radiation specialists from both the U.K. and the U.S. gave the proposal poor reviews. Brian Maddock of the U.K.'s Central

Electricity Research Laboratories said it is "too complicated." In terms of the NRPB's derivation of limits and demonstration of compliance, he added, the "scientific basis is rather weak." A leading U.S. researcher, who asked not to be identified, questioned the document's complexity: "It's weird. It's hard to follow the rationale."

Dr. P. Czerski of the U.S. Center for Devices and Radiological Health at the Food and Drug Administration in Rockville, MD, also criticized the scientific groundwork for the limits. "They have sacrificed basic physical and biological accuracy for some rather doubtful mathematical elegance," he said in a telephone interview.

For workers, the proposal is keyed to two-hour exposures per day: at 50 Hz, 30 kV/m and 1.88 mT for electric and magnetic fields, respectively [at 60 Hz, the limits are 25 kV/m and 1.57 mT, respectively]; for 30-100 MHz, a power density of 1 mW/cm², rising to 5 mW/cm² at 500 MHz up to 300 GHz.

For the general public, the proposals for up to 5 hours a day and continuous exposures are: at 50 Hz, 12 kV/m (electric), 0.76 mT (magnetic) and 2.6 kV/m, 0.174 mT, respectively [at 60 Hz, the limits are 10 kV/m and 0.63 mT (5-hour) and 2.13 kV/m and 0.145 mT (continuous)]; for 30-300 MHz, a power density of 400 uW/cm² (5-hour) and for 10-300 MHz, 80 uW/cm² (continuous); at 1.5 GHz, the limits rise to 2 mW/cm² (5-hour) and 400 uW/cm² (continuous).

After reviewing comments submitted in response to the proposal, NRPB plans to issue a final standard in early 1987. The document, *Advice on the Protection of Workers and Members of the Public from the Possible Hazards of Electric and Magnetic Fields with Frequencies Below 300 GHz: A Consultative Document* (May 1986), is available from NRPB, Chilton, Didcot, Oxon OX11 0RQ, U.K.

EPRI Reorganizes Its Radiation Program

Following a major reorganization, the Electric Power Research Institute (EPRI) has started a new radiation program, which will contain the old electric and magnetic fields sub-program — now renamed the "non-ionizing radiation" sub-program.

Dr. Leonard Sagan, an EPRI senior scientific advisor, will head the radiation program. Sagan effectively replaces Dr. Gordon Newell, who, as senior program manager of the health studies program, was in charge of research on electric and magnetic fields before it was moved to the new radiation program. Dr. Bob Patterson continues to oversee EPRI's contracts on the effects of power line radiation as the manager of the non-ionizing sub-program. Newell continues to monitor work on air pollution, occupational health and other environmental issues.

The other part of the radiation program will be a new EPRI initiative on the effects of ionizing radiation. No one has yet been selected to oversee this work.

The implications of the reorganization are still unclear. In a telephone interview from his office in Palo Alto, CA, Patterson said that the change should sharpen the focus of EPRI's efforts on radiation but added that it is unclear

HIGHLIGHTS

whether there will be any new research funds. EPRI's 1986 budget for power line health effects is \$1.7 million.

In order to help evaluate its electromagnetic radiation program, the institute has asked a number of researchers to give seminars in Palo Alto. Those invited include: Drs. Ross Adey, Jonathan Charry, H.B. Graves, William Kaune and David Savitz.

Some observers have speculated that the change was precipitated by EPRI's member utilities, who wanted the institute to do more research on the effects of power line radiation. When asked about this, Patterson said, "I don't believe it." He explained that the true litmus test would be an increase in his budget, and this, he said, has not happened.

Nevertheless, at September's symposium on power line effects (see p. 1), some utility representatives complained that EPRI was not servicing their needs. "EPRI is not helping me answer the questions on health and safety raised by our customers," Ronald Ponist of Duquesne Light Co. in Pittsburgh, PA, told *Microwave News*.

Patterson is hopeful that EPRI will begin sponsoring less-directed research on electromagnetic fields next year. This effort was to have gotten underway in 1986 (see *MWN*, November/December 1985), but was sidetracked by budget cuts.

VDT-Miscarriage Risk Downplayed by Epi Study

The first epidemiological study of reproductive risks among video display terminal (VDT) operators completed in the U.S. shows a slight, though insignificant, rise in spontaneous abortions and stillbirths for female workers who use VDTs more than 20 hours per week. The study did not address the risk of malformations among the offspring of VDT operators.

Drs. Bill Butler and Kelley Brix, of the University of Michigan in Ann Arbor, reported in late September that they found 26 spontaneous abortions and stillbirths in 120 pregnancies among women who worked at VDTs 21-40

hours per week. Controlling for smoking, alcohol and other variables that might have affected the pregnancies, they had predicted 21.2 abnormal outcomes in the study group.

In a telephone interview, Butler noted that the approximately 25 percent increase was not statistically significant and was likely due to chance. Both Butler and Brix recommend further study of VDT operators who use terminals more than half-time, however.

Workers who said they used VDTs 20 hours or less per week showed no signs of increased risk. The study, which considered spontaneous abortions and stillbirths jointly, also found no link between VDT-related stress and these abnormal outcomes, according to Butler, who cautioned that he still plans further analyses of the stress data.

The retrospective study was based on interviews with 728 women who worked in four Michigan state offices from 1980 to 1985. The women were selected from 26 different job classifications.

Butler and Brix presented their results on September 30 at the annual meeting of the American Public Health Association in Las Vegas, NV. Earlier in the month, state and union officials reviewed the preliminary results.

NIOSH Study Protocol Appealed

In an effort to overturn the controversial conditions — the elimination of questions on stress and fertility — placed on the epidemiological study at the National Institute for Occupational Safety and Health (NIOSH), Congressman Ted Weiss (D-NY) has asked the Secretary of Health and Human Services (HHS) to help override these constraints imposed by the federal Office of Management and Budget (OMB).

In a September 2 letter to HHS Secretary Otis Bowen, Weiss argued that, "There is general agreement that the revisions required by OMB will seriously weaken the study, making any results difficult to interpret." Weiss supported his claim by submitting a "Staff Paper," prepared by the congressional Office of Technology Assessment, which is critical of the OMB ruling and with a series of letters from epidemiologists familiar with the VDT-reproductive risks issue.

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In an interview, Phillips explained that he would have answered questions about the health risks associated with power lines differently a year ago. "You cannot refuse to accept the biological data any longer," he said. "I am sick of the arrogance that allows people to ignore the data." Phillips cited the European utility industry which, he said, is unwilling to accept recent experimental and epidemiological results. "There is also a certain amount of engineering arrogance in the U.S.," he added.

However, Phillips said that, overall, North American utilities "are finally taking the ELF problem seriously — admittedly reluctantly."

Pleas for More Research

Most presentations at the meeting ended with pleas for more research. Dr. Larry Anderson, who took over from Phillips at Battelle, said that there are three major study areas that need resolving: (1) reproduction and development; (2) nervous system, including biorhythms; and (3) carcinogenesis.

Among the utility representatives, there was a clear preference for research that can help answer questions about health risks, as opposed to laboratory studies. "We should be spending our money on studies that are most meaningful to our employees and the public," Dr. Sol Sax said in an interview. Sax, who is the chief physician at Ontario Hydro, specified the need for good epidemiological studies, provided that they are accompanied by good dosimetry. "There is room for animal studies," he added, "but *in vitro* work has to wait."

Dr. Robert Patterson of the Electric Power Research Institute agreed. "The principal research needs are epidemiological studies of workers and the public," he told *Microwave News*. And Drs. Andrew Marino and H.B. Graves, who are usually on opposite sides of the ELF issue (Marino, both a lawyer and a researcher, represents plaintiffs; Graves is a consultant to the utility industry) also said that epidemiological research is the most important.

Funding remains scarce, however, and it is far from clear who will pay for such expensive studies at a time when

Growing Attention to ELF Risks

The Toronto utilities' symposium was but one of many that are addressing ELF risks.

For instance, a small group of researchers met in Seattle, WA, August 14-15 to review *Electric Power Use and Possible Biological Mechanisms of Interaction*. The discussion focused on pineal and cellular effects as they relate to the causes of cancer. The meeting was organized and hosted by Battelle.

And at the 1986 Department of Energy and Electric Power Research Institute Contractors' Review, to be held in Denver in November (see Conference Calendar), there will be a workshop on epidemiological issues related to ELF fields. Attendance at the workshop will be by invitation only, although the contractors' review is open to all.

Would You Buy a House Next to a Power Line?

Some of the symposium's most lively moments occurred at an evening panel session, when a member of the audience asked five well-known ELF bioeffects experts whether they would live along the right-of-way of a power line.

The hypothetical question presupposed that each panelist had a family with two young children and that the house next to the transmission line, though identical in every respect to another one, was \$25,000 cheaper. Here's what the experts said:

Dr. H.B. Graves, a consultant based in Reston, VA: "Yes. No question about it, I'd buy the home along the right-of-way."

Dr. Andrew Marino, Louisiana State University Medical School, Shreveport, LA: "No. If I was bald and 65 years old, I might." He added that \$25,000 was not enough money to take the chance.

Dr. Richard Phillips, Environmental Protection Agency, Research Triangle Park, NC: "No." He explained that he is asked this question all the time and that his usual response is, "If it bothers you, don't buy the house." His unstated implication was that the power line would bother him.

Dr. Asher Sheppard, VA Hospital, Loma Linda, CA: "No." He said that his decision was based not on the risk of adverse health effects but on the corona noise and the loss of aesthetics due to the power line.

Dr. Sol Sax, Ontario Hydro (moderator): "Yes. I would buy the house next to the transmission line and pocket the difference." He explained that he would not live right under a 500 kV line, but would do so along the right-of-way.

research budgets for all types of non-ionizing radiation have been slashed (see *MWN*, November/December 1985).

Marino placed the responsibility for funding the studies on the utilities. At one of the evening sessions, he pointed out that all the epidemiological studies done to date "have not cost the industry a dime." Researchers have had very little money and have done the best possible work with the available data, he said: "If you want new results you are going to have to pay for them."

More than 15 reports have identified some association between ELF fields and cancer over the last few years (see *MWN*, March/April and May/June 1986).

The need for better dosimetry will be simplified by a new pocket-size "electromagnetic dosimeter" developed by Paul Heroux of IREQ, the research branch of Hydro-Quebec. This dosimeter can measure 60 Hz electric and magnetic fields every minute for 18 days over a dynamic range of 84 dB, starting at 0.5 V/m and 3 nT, as well as high frequency (5-20 MHz) electromagnetic fields. (The 60 Hz magnetic field is measured in the x, y and z directions.) The data can then be unloaded into an HP-200 microcomputer. Each dosimeter costs approximately \$500 (U.S.). ●

BOOKS

Selected Reviews

W. Stephen Cheung and Frederic H. Levien, editors, **Microwaves Made Simple: Principles and Applications**, Norwood, MA: Artech House, Inc., 1985, 356 pp., \$59.00.

The staff of the Microwave Training Institute in Mountain View, CA, based this primer on its training program. Editors Cheung and Levien take the reader from the basic mathematics of microwaves to a range of applications, including electronic warfare, radar systems and health sciences. The book assumes some knowledge of electronics and mathematics. Cheung works for the NASA-Gravity Probe Program at Stanford University in Palo Alto, CA, and Levien is president of CTT, Inc., in Santa Clara, CA.

A. Chiabrera, C. Nicolini and H.P. Schwan, editors, **Interactions Between Electromagnetic Fields and Cells**, New York, NY: Plenum Press, 1985, 640 pp., \$95.00.

This is a most useful collection of papers first presented at a workshop in Erice, Italy, in September 1984. Although already two years old, the three dozen papers cover theories and findings that are still at the forefront of bioeffects research — including Dr. Abe Liboff on cyclotron resonance (his most recent contribution to this model was the highlight of this summer's Bioelectromagnetics Society meeting), Dr. Carl Blackman on calcium efflux and Dr. W. Grundler on non-thermal effects on yeast at 42 and 84 GHz. Also, the late Herbert Pohl presents a succinct review of his work leading to the hypothesis that AC fields play a crucial role in cellular reproduction, and Dr. Martino Grandolfo outlines the debate over safety standards at ELF and RF/MW frequencies. For those interested in the politics of this field, there is a paper by Dr. Sol Michaelson, who tries to show that calcium efflux is a thermal effect. Interestingly, in his introduction, Dr. Herman Schwan indicates that he is still not totally convinced that there are direct interactions between non-ionizing fields and biomolecules.

M. Grandolfo, S.M. Michaelson and A. Rindi, editors, **Biological Effects and Dosimetry of Static and ELF Electromagnetic Fields**, New York, NY: Plenum Press, 1985, 697 pp., \$97.50.

In these proceedings of a course held in Erice, Italy, in November 1983, many of the leading researchers in the field — L.E. Anderson, A. Chiabrera, R. Conti, W.T. Kaune, B.G. Knave, W.G. Lotz, R.D. Phillips, M.H. Repacholi, H.P. Schwan, T. Tenforde and H. Wachtel — are represented, among others. This typescript volume contains a large number of well-referenced review papers on dosimetry, effects and measurement of static and power frequency fields.

Sonny Kleinfeld, **A Machine Called Indomitable**, New York, NY: Times Books, 1986, 250 pp., \$16.95.

Kleinfeld chronicles the story behind the development of the first nuclear magnetic resonance (NMR) scanner for humans. Rummaging through scrap bins and bargain basement hardware stores for parts, Dr. Raymond Damadian overcame peer ridicule and numerous grant application rejections to build his "indomitable" imager. He finally

obtained a patent and FONAR, his company, has since grown into a multi-million dollar enterprise. Whether other companies infringed on his patent is now in litigation and, if FONAR ultimately wins, more books will undoubtedly follow.

Andrew Marino and Joel Ray, **The Electric Wilderness**, San Francisco, CA: San Francisco Press, 1986, 120 pp., \$18.75.

By all accounts, Dr. Marino charmed the utility executives at September's power line meeting (see story on p.1). Those who liked his speech will like this book — a personal account of a 765 kV line siting battle in New York state. Though the narrative begins 12 years ago, it has strong similarities to the battles taking place all over the U.S. today. Pitted against Marino and his mentor, Dr. Robert Becker, who argued that power lines present a potential health hazard, were Drs. Herman Schwan, Sol Michaelson and Morton Miller, all of whom disputed such claims on behalf of power companies. Intertwined with the power line controversy are those associated with the Navy's Project ELF (aka Project Sanguine and Project Seafarer) and bone healing devices. Marino and Ray, a freelance writer, ask: If EM radiation can have beneficial non-thermal medical applications, could it not also entail risks to human health? The book ends with the establishment of the New York Power Line Project, the closing down of Becker's lab and Marino calling for "a serious, sustained Congressional investigation."

Meg Patterson, **Hooked? NET: The New Approach to Drug Cure**, London, U.K.: Faber and Faber, 1986, 280 pp., 4.95 pounds (paperback).

Since 1973, Dr. Meg Patterson has been developing a NeuroElectric Therapy (NET) stimulator for all types of addictions, including drugs, alcohol and cigarettes. In this personal account, she describes her success in treating addicts and her failure to get her device on the market. The technical details are rather sketchy, but Patterson offers a number of intriguing facts. For instance, she posits that specific frequencies (5-2,000 Hz) are best for treating particular addictions and notes that the Queen of England has had PEMF therapy for a strained shoulder. Patterson has helped a number of rock and roll stars fight off drug dependencies — most recently, she weaned Boy George off heroin; in return, her research has been supported by such unlikely sources as Atlantic Records and rock concerts. At a time when the U.S. is working itself into an anti-drug frenzy, one wonders why no one is taking Patterson more seriously.

Peter Rainger, David N. Gregory, Robert V. Harvey and Antony Jennings, **Satellite Broadcasting**, New York, NY: John Wiley & Sons, 1985, 326 pp., \$29.95.

This is a step-by-step guide to the operations of direct broadcast satellite (DBS) systems, including satellite orbits, economics, laws and regulations. The authors, who are British, have attempted to present information for use around the world but acknowledge that they only partially achieve this goal. Though technical by nature, the book is written in simple language and is accessible to the uninitiated.

Recently Published

Hugh G.J. Aitken, **The Continuous Wave: Technology and American Radio, 1900-1932**, Princeton, NJ: Princeton University Press, 1985, 589 pp., \$67.50 (hardcover), \$19.95 (paperback).

J.E. Bridges, G.L. Ford, I.A. Sherman and M. Vainberg, editors, **Electrical Shock Safety Criteria: Proceedings of the First International Symposium**, Elmsford, NY: Pergamon Press, 1985, 368 pp., \$82.50.

Alexander Scott Gilmour, **Microwave Tubes**, Norwood, MA: Artech House, 1986, 490 pp., \$60.00.

Louis J. Ippolito, Jr., **Radiowave Propagation in Satellite Communications**, New York, NY: Van Nostrand Reinhold, 1986, 241 pp., \$39.95.

Darko Kajfez and Pierre Guillon, **Dielectric Resonators**, Norwood, MA: Artech House, 1986, 500 pp., \$60.00.

Eugene Knott, John Shaeffer and Michael Tuley, **Radar Cross Section**, Norwood, MA: Artech House, 1985, 462 pp., \$60.00.

Preston E. Law, Jr., **Shipboard Antennas**, Norwood, MA: Artech House, 1986, 575 pp., \$61.00.

Thomas A. Milligan, **Modern Antenna Design**, New York, NY: McGraw-Hill, 1985, 408 pp., \$44.50.

J. Musil and F. Zacek, **Microwave Measurements of Complex Permittivity by Free Space Methods and Their Applications**, Amsterdam, The Netherlands: Elsevier Science Publishers, 1986, 275 pp., \$64.75.

Robert A. Pucel, editor, **Monolithic Microwave Integrated Circuits**, New York, NY: IEEE Press, 1985, 501 pp., \$69.95 (\$41.95 for IEEE members).

D. Curtis Schleher, **Introduction to Electronic Warfare**, Norwood, MA: Artech House, 1986, 559 pp., \$61.00.

S.S. Swords, **Technical History of the Beginnings of Radar**, London, U.K.: Peter Peregrinus, 1986, 325 pp., \$60.00.

Leung Tsang, Jin Au Kong and Robert T. Shin, **Theory of Microwave Remote Sensing**, New York, NY: John Wiley & Sons, 1985, 613 pp., \$44.90.

J. Van Bladel, **Electromagnetic Fields**, New York, NY: Hemisphere Publishing Corp., 1985, 556 pp., \$39.95.

J.R. Wait, **Introduction to Antennas and Propagation**, Piscataway, NJ: IEEE Service Center Publishing Dept., 1986, 272 pp., \$25.00.

Forthcoming

Andrew Marino, editor, **Foundations of Modern Bioelectricity**, New York, NY: Marcel Dekker, February 1987, 27 chapters, Price: NA.

Charles Polk and Elliot Postow, editors, **CRC Handbook of Biological Effects of Electromagnetic Fields**, Boca Raton, FL: CRC Press, Fall 1986, 576 pp., \$165.00.

Morris Waxler and Victoria Hitchens, editors, **Optical Radiation and Visual Health**, Boca Raton, FL: CRC Press, Late 1986, 272 pp., \$87.00.

CONFERENCES

November 2-6: **1986 IEEE Conference on Electrical Insulation and Dielectric Phenomena**, Hilton Hotel, Claymont, DE. Contact: Roy Wootton, 501-3W57, Westinghouse R&D Center, 1310 Beulah Rd., Pittsburgh, PA 15235, (412) 256-2108.

November 4-6: **4th International Symposium on Antennas: JINA'86**, Acropolis Convention Center, Nice, France. Contact: J.L. Guiraud, CNET-PAB Centre de La Turbie, 06320 Cap D'Ail, France, (93) 411717.

November 6-7: **Millimeter Wave/Microwave Measurements and Standards for Miniaturized Systems**, U.S. Army Missile Command, Redstone Arsenal, AL. Contact: Malcolm Shelton, U.S. Army TMDE Support Group, Attn: AMXTM-SM, Redstone Arsenal, AL 35898, (205) 876-1550.

November 7-10: **8th Annual Conference of the IEEE Engineering in Medicine and Biology Society**, Worthington Hotel, Fort Worth, TX. Contact: Dr. Charles Robinson, Rehabilitation R&D Center, Hines VA Hospital, Box 20, Hines, IL 60141, (312) 7200, ext. 2240.

November 10-12: **RF Expo East**, Marriott Copley Place, Boston, MA. Contact: James MacDonald, *RF Design*, 6530 S. Yosemite St., Englewood, CO 80111.

November 17-20: **31st Annual Conference on Magnetism & Magnetic Materials**, Hyatt Regency Hotel, Baltimore, MD. Contact: Diane Suiters, 655 15th St., NW, Suite 300, Washington, DC 20005, (202) 639-5088.

November 18-20: **1986 DOE-EPRI Contractors Review: Biological Effects of Electric and Magnetic Fields**, Sheraton Tech Center, Denver, CO. Contact: W/L Associates, 600 S. Frederick Ave., Suite 401, Gaithersburg, MD 20877, (301) 948-0642.

November 19-23: **Fall Conference of the Society of Telecommunications Consultants (STC)**, Intercontinental Hotel, San Diego, CA. Contact: Effie Cooper, STC, 1 Rockefeller Plaza, Suite 1410, New York, NY 10020, (212) 582-3909.

November 30-December 5: **Symposium on Heat and Mass Transfer in Thermally Significant Vessels and the Microcirculation**, Anaheim, CA. Contact: Prof. Ken Diller, Biomedical Engineering Center, University of Texas, ENS 612, Austin, TX 78712, (512) 471-7167.

December 3-4: **Workshop on Microwave Applications in the Food and Beverage Industry**, Toronto, Ontario, Canada. Contact: Gillian MacLeod, Ontario Hydro, 620 University Ave., U4-E4, Toronto, Ontario M5G 1X6, Canada, (416) 592-5526.

December 4-5: **28th Conference of the Automatic RF Techniques Group (ARFTG)**, Don Cesar Beach Resort, St. Petersburg Beach, FL. Contact: Richard Irwin, Systems for Automatic Test, 1292 Reamwood Ave., Sunnyvale, CA 94089, (408) 734-9447.

December 11-14: **3rd Annual Meeting of the American Society of Clinical Hyperthermic Oncology (ASCHO)**, Gene Autrey Hotel, Palm Springs, CA. Contact: Dr. H. Bicher, ASCHO, 14427 Chase St., Suite 203, Panorama City, CA 91402, (818) 895-1379.

COMMUNICATIONS

EPA-FCC Surveys... EPA's Richard Tell and FCC's Dr. Robert Cleveland measured RF radiation levels in Portland, OR, the last week of July and on Lookout Mountain near Denver, CO, the week of September 22. Portland has been the scene of a continued radiation controversy, especially in the community near the antenna farm in Healy Heights. Its moratorium on new radiation sources of more than 500 watts is still in effect and the city is now considering the adoption of a 200 $\mu\text{W}/\text{cm}^2$ exposure standard (see *MWN*, July/August and November/December 1985). No action on either the standard or the moratorium is expected until EPA issues its report. "We're in limbo," Steve Gerber of the Portland Bureau of Planning told *Microwave News*. Similarly, people living near Lookout Mountain have raised concerns over the radiation levels associated with the TV and FM antennas sited there. A report on the Portland survey is scheduled to be released before the end of the year. The Denver study will be published in 1987. These are the third and fourth EPA-FCC radiation surveys: the first was in Honolulu, HI (see *MWN*, January/February 1985); the second was on Cougar Mountain outside Seattle, WA (see *MWN*, January/February 1986).

RF Compliance Testing... With broadcasters now facing FCC rules concerning human exposures to RF/MW radiation and with EPA weighing a national standard as low as 100 $\mu\text{W}/\text{cm}^2$, new markets are opening up for engineering firms that can compute and measure RF/MW power levels and show that their clients are complying with the applicable federal, state or local regulations. Comsearch, Inc., may be the first company to openly position itself to win a share of the business. The firm has begun offering testing and support services for broadcast and satellite stations and recently opened an RF testing lab at its new headquarters in Reston, VA. For more information, contact Comsearch's Nancy Whitacre, 11720 Sunrise Valley Dr., Reston, VA 22091, (703) 476-2683.

COMPATIBILITY & INTERFERENCE

Computer LAN and Satellites... The National Oceanic and Atmospheric Administration (NOAA) has filed comments opposing a proposal to link computers in a local area network (LAN) by using 1.70-1.71 GHz radiation — a frequency now allocated to NOAA for transmitting weather satellite data. The FCC proposed the LAN rules last May in response to a petition from Motorola, which contended that wireless networks are needed because typical LANs are difficult and expensive to change. NOAA responded that, under the FCC proposal, radiation-based LANs would interfere with receivers of NOAA satellite signals. NOAA wants the FCC to move the microwave LANs to another frequency band or to prohibit them altogether. At the same time, NOAA — which argued that Motorola has vastly underestimated the number of receivers that would be affected — is asking users of its satellite signals to register so that the extent of the EMI problem can be gauged. For more information, contact Richard Barth, NOAA, Department of Commerce, Room 6106, Herbert Hoover Bldg., Washington, DC 20230, (202) 377-0635.

Beyond Captain Midnight... When John MacDougall, alias Captain Midnight, jammed a Home Box Office (HBO) satellite signal last April (see *MWN*, July/August 1986), he did more than just irritate HBO executives and FCC staffers. The incident also sent a chill down the spine of those in charge of the military's satcom systems. According to the cover story in the October issue of *Mother Jones*, a study prepared for AT&T by SRI International's Strategic Studies Center in Arlington, VA, revealed that, during the aborted rescue attempt of U.S. hostages in Iran in 1980, each side monitored and sabotaged the other's communications in a full-scale electronic battle. Furthermore, the magazine reports, DoD has not improved the anti-jamming capabilities of its satellites in the last six years and interference is still a very real threat to vital military systems. Indeed, speaking at the *Electronics and Aerospace Systems Conference* in September, Donald Latham, assistant DoD secretary for C³I, admitted that UHF-band satellites such as FleetSatCom are "vulnerable to some extent." As reported in the September 15 *Aviation Week*, he said that SHF-band satellites, such as those in the Defense SatCom System, have some, albeit limited, protection. Future satellites, such as Milstar, will be able to ward off interfering signals, he noted. Milstar isn't scheduled to be operational until the 1990s, however.

RFI Fence... A CBS affiliate in Columbus, OH, has built a 31-foot-high and 740-foot-long concrete fence to protect its C-band earth stations from RFI, according to a report in the September 8 *Broadcasting*. (The actual fence is 27 feet high and sits on a 4-foot berm.) Fanwall Corp. of Arlington, VA, designed the irregular-shaped wall for WBNS-TV so that the station could put the dishes next to its studios in town rather than 20 or 30 miles away.

Power Line-RF Interference... The Canadian Electrical Association (CEA) has awarded Ontario Hydro a \$200,000 contract to study *Power Line Carrier Radiofrequency Interference to and from Radio Communication Services: Phase I* (Contract No. 200-T-387). Among the project's objectives are how power line configurations determine nearby field strengths as well as how, and under what conditions, the configurations affect their susceptibility to RF signals in the 30 kHz to 1 MHz band. In addition, Ontario Hydro will build models to predict whether power line and RF sources can coexist. For more information, contact CEA's R.A. Del Bianco, Suite 500, 1 Westmount Square, Montreal, Quebec H3Z 2P9, Canada, (514) 937-6181.

GOVERNMENT

FCC RFI Crackdown... The FCC continues to get tough on computer makers whose products fail to meet Part 15 RFI rules for computing devices (see *MWN*, March/April 1986). The commission's seven-week delay in approving Tandy Corp.'s new personal computers — models 1000 EX, 1000 SX — hurt sales, especially after Tandy had announced them with great fanfare. Widely covered by the press and often criticized by the computer industry, the FCC's stepped-up RFI certification program has resulted in the collection of approximately 100 \$2,000 fines in the last year, according to *The Wall Street Journal* (September 5). Commis-

sion officials are unfazed by the harsh words from the industry, however; they cite the growing number of interference complaints. . . . In a related action, the FCC rejected petitions from Electronics Associates, Inc., Cray Research, Inc. and Denelcor, Inc. for exemption from Part 15 rules for computers used for research, engineering and other specialized applications. The three computer makers had asked to be excused from testing their limited-production computers because of the high cost per unit. After reviewing the 32 sets of comments and 7 sets of reply comments filed in response to its August 1984 Notice of Proposed Rulemaking (see *MWN*, October 1984), the commission rejected the petitions because it foresaw difficulties in "uniformly interpreting" the resulting rule. In its notice released on August 12, the FCC noted, however, that most of the specialized computers fall into existing categories for exemptions. . . . The FCC confiscated approximately \$10,000 worth of RF amplifiers and transmitters from H&Y Electric Supply, a Louisville, KY, distributor, in late August for noncompliance with interference regulations despite a prior, written warning. A conviction could result in a maximum penalty of a \$100,000 fine and a year imprisonment.

MEASUREMENT

Magnetic Fields. . . . Dr. Maria Stuchly of Canada's Radiation Protection Bureau in Ottawa has surveyed previously reported measurements on human exposures to static and time-varying magnetic fields from zero to a few hundred kilohertz. The largest DC fields are associated with both NMR imagers and high technology devices like Tokamak fusion reactors. Proposed transportation systems using magnetic levitation (Maglev) would entail the strongest DC fields (up to 100 mT) for relatively long exposure times. Among household appliances, can openers and hair driers generate the largest 60 Hz fields — up to 2 mT at 3 cm. Although Stuchly covers the 0.1-0.3 uT ELF fields 30 cm from VDTs, she omits the stronger VLF emissions that are up to an order of magnitude higher. She told *Microwave News* that when she wrote the paper in early 1985 there were no published data on the VLF fields emitted by the VDTs' flyback transformers. Stuchly's paper appears in the August issue of *Health Physics*. . . . Ontario Hydro's Dr. S.M. Harvey has detailed the "Requirements for 60 Hz Magnetic Field Dosimetry" in a working paper issued on May 5. For more information, contact Harvey at Ontario Hydro's Research Division, 800 Kipling Ave., Toronto, Ontario M8Z 5S4, Canada. . . . Dr. Henry Baltes of the University of Alberta in Edmonton, Canada, and Dr. Radivoje Popovic of Landis & Gyr Corp. in Zug, Switzerland, have prepared a major review paper on "Integrated Semiconductor Magnetic Field Sensors," which appears in the August issue of the *Proceedings of the IEEE*. . . . Researchers at the Sandia National Labs have combined a magnetic semiconductor with optical fiber technology to devise a magnetic field sensor with a response time of less than a nanosecond. Designed by Michael Butler and Stephen Martin, the sensor can monitor rapidly changing magnetic fields at frequencies of up to 5 GHz in noisy environments. "It may also find application in the direct detection of intense RF fields," they believe. For more information, contact Butler and Martin

at the Microsensor Division, Sandia National Labs, Albuquerque, NM 87185.

MEDICAL APPLICATIONS

Stun Gun Cure. . . . High voltage, low amperage electric shock therapy is being used as a new treatment for poisonous snake bites in the Amazon jungle areas of Ecuador, where anti-venom medicine is often not readily available. In the July 26 *Lancet*, Dr. Ronald Guderian, an American missionary physician, and his colleagues reported curing 34 snake bite victims by using shocks applied with stun guns within 30 minutes of the bites. (Outboard motors have also been used as sources of current.) The treatment consists of 4-5 shocks of 20-25 kV with less than 1 mA direct current to the bite area, each lasting 1-2 seconds with 5-10 seconds between each jolt. In all cases the pain disappeared within 10-15 minutes and the swelling, bleeding, blistering, shock and renal failure which usually accompany snake bites did not develop. Shocks applied hours after bites also produced positive results. Guderian and coworkers noted that others have also successfully used this technique to treat bites from scorpions and ants. They speculate that electrospasms shut down the local blood vessels, confining the short-living venom long enough for it to become inactive. The letter prompted a reminder by Andrew Pearson (August 23 *Lancet*) that, in 1979, an Australian research team reported that a crepe bandage applied firmly over the bite area to prevent venom absorption was perhaps "the cheapest and best form of first-aid."

MEETINGS

T&D EMI in Anaheim. . . . At the same time that many utility staffers interested in the effects of power line radiation were at the Toronto international symposium (see story on p.1), the 10th *IEEE/PES Transmission and Distribution Conference and Exposition* was being held in Anaheim, CA. One of the Anaheim sessions was on "AC Fields and Radio Interference" and featured papers on the "Effects of Power Line Structures on AM Broadcast Stations" (No.86T&D516-9), by M.S. Hammam and R.S. Baishiki of Pacific Gas & Electric Co. (PG&E); "Interference from 60 Hz Electric and Magnetic Fields on Personal Computers" (No.86T&D609-2), also by PG&E's Baishiki, in collaboration with GE's Dr. Don Deno; and "Analysis of Radio Interference and Substation Modifications for Upgrading a 115 kV Substation to 230 kV" (No.86T&D517-7), by a team from Louisiana Power & Light Co. and Westinghouse Electric Corp. Copies of each paper are available for \$3.00 (IEEE members) or \$6.00 (others) from the Single Publications Sales Dept., IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854.

OCCUPATIONAL HEALTH

Electrical Risks. . . . Two recent studies shed new light on the potential hazards associated with electrical occupations. The first indicates that working with electricity may increase the risk of contracting amyotrophic lateral sclerosis (ALS), a degenerative and usually fatal disease of the motor neurons commonly known as "Lou Gehrig's disease." Drs. Dennis Deapen and Brian Henderson of the University of Southern

UPDATES

California School of Medicine in Los Angeles report that patients with ALS were almost four times as likely as controls to have worked in electrical occupations. A history of severe electric shock resulting in unconsciousness was also significantly associated with ALS (odds ratio of 2.8). Other physical traumas that caused unconsciousness also were slightly significant. Suspected risk factors, such as prior diseases and toxic chemicals, were not significant, however. The paper appears in the *American Journal of Epidemiology*, 123, pp.790-799, 1986. In the second study, researchers sought a link between background ionizing radiation and acute myeloid leukemia but, instead, found that electrical technicians, electrical welders and computer and telephone mechanics had a greater than average risk of developing the disease (odds ratio of 3.8). Dr. Ulf Flodin, of the Department of Occupational Medicine at the University Hospital in Linköping, Sweden, is the principal author of the paper, which appears in the *Archives of Environmental Health*, 41, pp.77-84, 1986.

NIOSH RF Heater Study Review. . . . NIOSH held a public meeting on September 11 to review its plans for an epidemiological study of reproductive risks among male RF heater operators. A separate study of exposed women is likely to be ready for review by early 1987, agency staffer Clinton Cox reports. The two-part project, which has been underway since 1978 (see *MWN*, February 1981), may get started by mid-1987, though Cox admits that further delays are possible. For more information, contact Cox at the Division of Biomedical and Behavioral Science, NIOSH, 4676 Columbia Parkway, Cincinnati, OH 45226, (513) 533-8482.

PEOPLE

Changes at DoD. . . . The Air Force's John Mitchell has been named chief of the Radiation Sciences Division at the School of Aerospace Medicine at Brooks Air Force Base in San Antonio, TX. Mitchell will now be responsible for laser and ionizing — as well as RF/MW — radiation. Dr. Jerome Krupp has taken over from Mitchell as chief of the radiation physics branch. Within the branch, James Merritt has become chief of the bioeffects section; Dr. David Erwin and William Hurt continue as the heads of the mechanisms and the RF/MW facility sections, respectively. . . . At the Office of Naval Research (ONR), Dr. Charles Rafferty took over from Dr. Tom Rozzell on October 1 as manager of the bioelectromagnetics program. Rafferty is currently on a six-month assignment and may continue there permanently. He came to ONR from the Department of Microwave Research at the Walter Reed Army Institute of Research. Rozzell has moved to the National Research Council (see *MWN*, July/August 1986).

POWER LINES

Florida Advisory Panel. . . . The Florida Department of Environmental Regulation (DER) has set up an advisory panel to help develop rules for siting transmission lines (see *MWN*, March/April 1986). Professor Lloyd Beidler of Florida State University in Tallahassee, who has worked on the mechanisms of taste stimulation and olfaction and who

is a member of the National Academy of Sciences, is chairing the six-member panel. The Electromagnetic Field Advisory Panel will help DER establish "reasonable" standards to protect the public from power line fields. Buck Oven of DER's Division of Environmental Permitting told *Microwave News* that he expects a proposal to be completed by May or June 1987 for consideration by the state's Environmental Regulation Commission. For more information, contact Oven at DER, 2600 Blair Stone Rd., Tallahassee, FL 32301, (904) 488-0130.

Go-Ahead for Australian Power Line. . . . In our last issue, we described the controversy over a 220 kV power line in Victoria, Australia. On August 11, the line was approved, because state Minister for Health David White concluded that it "did not pose any public health problems." Among the official reasons for the state government's approval were: (1) "The fact that all sides of the debate agree that no existing epidemiological studies conclusively demonstrate any health risk associated with high voltage transmission lines"; (2) "The fact that electric fields associated with the proposed [State Electricity Commission of Victoria] transmission lines are half the minimum acceptable standard recommended by the World Health Organization (WHO) of 2 [kV/m] at the edge of the easement"; and (3) "The fact that magnetic fields under the transmission lines are extremely low, typically in the range of 5 to 50 milligauss compared with a WHO minimum standard of 3,000 milligauss." Referring to the studies of Dr. Jerry Phillips of the Cancer Therapy and Research Foundation in San Antonio, TX, White said that experiments on cell tissue are of "limited value" in resolving questions about the health effects of electromagnetic radiation (see *MWN*, July/August 1986). Overall, White said that his staff advised him that "animal studies do not support links between. . . ELF radiation and cancer."

STANDARDS

Walkie-Talkie EMI. . . . The IEEE Committee C37 on Power Switchgear has approved a two-year "trial use" standard to protect against EMI caused by operating walkie-talkies near electrical relays: it recommends that relays be tested in a shielded enclosure in fields between 10 and 20 V/m over the 25-1,000 MHz frequency range. In an interview with *Microwave News*, Douglas Dawson of Southern California Edison Co., chairman of the IEEE's Power Engineering Society working group that developed the measure, explained that the impetus for the standard came from numerous reported EMI incidents over the past decade, notably several at nuclear power plants (see *MWN*, March/April 1986). Differences among panel members over the acceptable interference level prevented the group from issuing a final standard, he said, adding that he expects the interim measure, *Withstand Capability of Relay Systems to Radiated Electromagnetic Interference (C37.90.2)*, to provide data on testing methods and on the effectiveness of the limits. He hopes that a final standard can be issued using these data. For more information, contact Dawson at SoCal Edison, PO Box 800, Rosemead, CA 91770, (818) 302-1676. Due to printing delays, the interim standard will not be available until 1987.

Satcom Antennas . . . The Electronic Industries Association (EIA) has published Recommended Standard, EA-411-A, *Electrical and Mechanical Characteristics of Earth Station Antennas for Satellite Communications* (see *MWN*, May/June 1986). The new standard replaces EIA-411 (released in 1973) and was developed by a subcommittee chaired by Roland Schwerdtfeger of Scientific Atlanta Co. A copy is available for \$40.00 from the EIA Standards Sales Office, 2001 Eye St., NW, Washington, DC 20006, (202) 457-4966.

ETC . . .

Odds and Ends . . . The lead article in the September issue of *Scientific American* is "The Microwave Problem" by Drs. Ken Foster of the University of Pennsylvania and Bill Guy of the University of Washington. The article has received mixed reviews from members of the community. Watch for replies on the magazine's letters page. Interestingly, the same issue has an article on "The Blood-Brain Barrier" by Gary Goldstein and Lorris Betz of the University of Michigan Medical Center. In contrast to Koslov's statements at the EPA hearing (see p.2), Foster and Guy dismiss a low-intensity microwave effect on the BBB. . . . Variations in the earth's magnetic field may help "lost" salamanders find their home ponds. In the August 15 *Science*, John Phillips of Yale University reports that salamanders not only navigate by a compass mechanism but have map sense, as well. . . . A short circuit in an umbilical cord connector caused the inadvertent ground launch of a Raytheon Sidewinder air-to-air missile from an F-15J fighter in a hangar at an air base near Tokyo, Japan, according to the September 29 *Aviation Week*. . . . Drs. Stewart Jaslove and Peter Brink, of the State University of New York in Stony Brook, examine "The Mechanism of Rectification at the Electronic Motor Giant

Synapse of the Crayfish" in the September 4 *Nature*. . . . In this column in our March/April issue, we reported that a jury awarded \$1 million to a psychic after she alleged losing her special power following a CAT scan. According to an August 9 UPI item, a Philadelphia judge rejected the jury's decision and ordered a new trial, saying that the award was "so grossly excessive as to shock the court's sense of justice." . . . A front-page story in the September 14 *New York Times* described the emerging uses of thin films of synthetic diamonds. One of the applications cited is the U.S. Navy's desire for diamond radomes. (The diamond coatings are made using a microwave discharge.) These were no doubt discussed September 17-19 at the *18th Electromagnetic Window Symposium* sponsored by Georgia Tech in Atlanta. . . . Researchers from the New Mexico Institute of Mining and Technology and from the State University of New York in Albany have published "Abnormal Polarity of Thunderclouds Grown from Negatively Charged Air" in the September 26 *Science*. See also a discussion of the paper in the September 27 *Science News*. . . . The 26th annual meeting of the American Society of Dowsters took place in Danville, VT, in September and, according to an item in the September 28 *New York Times*, there was more talk about possible electromagnetic pulls on the dowser's pineal and adrenal glands. A letter from Tom Williamson of Surrey, U.K., published in the April 17 *Nature*, suggests that magnetic gradients must exceed one nanotesla per meter for dowsters to find water. . . . And finally, there is the strange story of the Rumanian family that turned up at the U.S. Capitol on September 4 with two dozen suitcases and asked a guard for asylum — partly because they claimed they were being bombarded by radiation in their California home. It turned out that the family of nine already had visas which were good until 1988. Their story quickly disappeared from the newspapers without further explanation.

AM Radiation Lawsuit (continued from p.1)

KGA broadcasts an omnidirectional signal during the day and a northwesterly, directional signal at night, both at 1,510 kHz. According to the complaint, the DiLuzio's house is in the path of the directional signal used at night.

Constant RFI Problems

The DiLuzios and their neighbors have complained for years about RF interference (RFI) to their radio and TV reception and to their telephones. In addition, the signal is reportedly so strong in the community that chain-link fences and metal objects inside homes can act as receivers.

During the building of the Mullan Road School in 1977, workers suffered electrical shocks and burns. Inside the school, students and teachers reported getting shocks until, in 1981, a grounded, copper roof was installed. The shielding cost more than \$50,000, according to a feature story in the May 26, 1985 *Spokane Spokesman-Review*.

AM radio signals are generally thought to be far less harmful than FM signals. Recent studies by Dr. Om Gandhi of the University of Utah in Salt Lake City are forcing a re-evaluation of this view (see *MWN*, July/August 1985 and

July/August 1986). According to Glassman, the DiLuzios were unaware that the RF fields might be hazardous until a cancer specialist treating Mrs. DiLuzio asked if she had been exposed to RF radiation.

The Environmental Protection Agency (EPA) listed the Spokane area, where there are numerous broadcast towers, on its list of RF radiation "hot spots" (see *MWN*, January/February and May 1985). ●

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