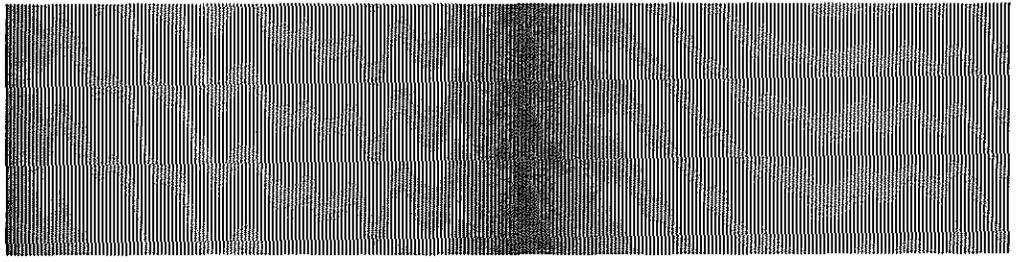


MICRO WAVE NEWS



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A Report on Non-Ionizing Radiation

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INSIDE...

ELF NEWS pp.2-7

Power Line Talk

Wertheimer & Leeper's Reanalysis of NY Adult Cancer Study: A Link Emerges

State Proposals on ELF Fields

Siting Schools Near Power Lines

Measurement Roundup

HIGHLIGHTS pp.7-9

DOD Shuts Down EMP Simulators

Broadcasters' Compliance Costs for RF Rules Revised

Alling TACAN Technician

Denied Workers' Compensation

Cape Cod Cancer Study Looks at EMFs

FROM THE FIELD pp.9-10

Henhouse PMF Project:

Communiqué from Madrid, Spain

UPDATES pp.10-12

EPA Revises RF/MW Bioeffects Report •

Atmospheric Impact of EM Weapons •

Ambulance Strobe EMI • Sunlight Activates

HIV • Competing with Japan • Finnish NIER

Rules • MW Oven Applications • Predicting

FM & TV Radiation Levels • NY's Suffolk

County VDT Bill • Protecting Lady Liberty

from Lightning • MWs Speed Up Chemical

Reactions • New EM Energy Newsletter •

Changes at EEPA and EPA • VDT EMF

Shield • Gordon Conference • and more....

CONFERENCES p.15

New Listings

Upcoming Meetings

VDT Use Linked to an Increased Miscarriage Risk

Women who used video display terminals (VDTs) more than half the workweek during the first three months of pregnancy were more likely to suffer miscarriages than those doing other types of office work, according to a new epidemiological study from Kaiser Permanente in Oakland, CA. Their offspring also had an increased rate of birth defects, though this finding was not statistically significant.

In the June issue of the *American Journal of Industrial Medicine*, Kaiser's Marilyn Goldhaber, Michael Polen and Dr. Robert Hiatt report that clerical workers who used VDTs more than 20 hours a week had more than twice as many miscarriages as women who performed similar tasks without VDTs. Kaiser provides health care and medical coverage to approximately two million members.

"I don't think these are definitive findings, but we did identify a statistically significant association," Goldhaber told *Microwave News*. "The VDT-pregnancy issue needs more research." She added that her study was not designed to determine the causes of the miscarriages. "Not much is known about low-frequency, low-intensity magnetic fields, so we can't rule them out, nor can we eliminate the possibility that poor working conditions are responsible; and there is always the chance that the association is spurious," she said.

(continued on p.13)

ELF and the Pineal Gland: Cancer and Depression

The pineal gland is at the center of new hypotheses on the role of extremely low frequency (ELF) fields in the development of cancer and depression. Neurochemicals which are associated with the pineal have been linked – either directly or through their metabolites – to tumor formation and suicidal behavior.

To be sure, the links are still far from proven, but as Dr. Bary Wilson of the Battelle Pacific Northwest Labs in Richland, WA, said in a telephone interview, the data are "equivocal, but highly suggestive" of a major role for the pineal gland in a number of electromagnetic field (EMF) effects.

As early as 1981, researchers at Battelle reported that ELF electric fields can affect the hormones secreted from a rat's pineal gland. In June, at the *Annual Meeting of the Bioelectromagnetics Society (BEMS)*, Battelle's Dr. Fred Leung will report that rats which respond to a cancer-causing chemical develop more mammary tumors when exposed to ELF

(continued on p.14)

« Power Line Talk »

Consulting on power line health effects can be very lucrative. Dr. H.B. Graves, now chief scientist at Crowell & Moring, a Washington, DC, law firm, and formerly a professor at Pennsylvania State University, made over \$75,000 (U.S.) in six months as a consultant to the Health Department of Victoria in Australia. Graves reviewed the State Electricity Commission of Victoria's plans for the now-canceled Brunswick-Richmond line, paying special attention to the health risks associated with EMF exposure. According to documents released under the local equivalent of our Freedom of Information Act, Graves spent more than 850 hours on the job from October 1985 to March 1986, billing at the rate of \$90/hour. During one marathon week in February, Graves made close to \$7,000. In addition, he claimed approximately \$10,000 in expenses, including \$4,124 in airfare for his trip to Australia.

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It is likely that the Department of Energy (DOE) will have more money for research on the biological effects of power line fields in 1989. The House energy and water development subcommittee of the Appropriations Committee has increased DOE's budget from the \$2.2 million requested by the Reagan Administration to \$4 million. The new money is largely due to the efforts of Rep. George Brown (D-CA). The Senate has yet to act; any differences would have to be addressed later in a House-Senate conference. Still, one senior DOE official is optimistic. "There's a good chance the increase will pass," he said.

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A September 8 trial date has been set for the \$60 million Marcy-South power line lawsuit filed in January 1987 against the New York Power Authority (NYPA) (see *MWN*, March/April 1987). Landowners are claiming that the 345 kV line will create a "cancerphobia" corridor which will destroy the market value of their property. They want the NYPA to establish a right-of-way (ROW) of 2,400 feet, thereby limiting magnetic field exposures to a maximum of half a milligauss. Michael Gurda of Gurda, Gurda & McBride in Middletown, NY, will be representing many of the plaintiffs. NYPA's

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attorneys will include Tom Watson of Crowell & Moring. In mid-May, the NYPA announced that the entire 207-mile Marcy-South line was being energized for testing.

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In an April 2 editorial following the March 21 broadcast of the BBC's *Panorama* program on power line health risks, *The Lancet*, one of the world's leading medical journals, chastised the U.K.'s Central Electricity Generating Board (CEGB) for not spending enough money on research. The editors wrote that the £500,000 (\$940,000) budget is "nowhere near enough to support the studies, in the laboratory and by epidemiologists, that will be needed to resolve the question." Dr. Robin Cox, the CEGB's chief medical officer, issued a prompt reply – published in the journal's April 23 edition – noting that the board's new commitment of £500,000 actually represented a doubling of its budget on EMFs and that it had spent £3.5 million (\$6.5 million) on the problem over the past eight years. A commentary by Dr. Neville Goodman in the April 9 issue of the *British Medical Journal* called the documentary "well balanced" and praised those interviewed for not being "dogmatic." This appraisal was in stark contrast to accusations in Parliament that the show had engaged in scaremongering. Part of the problem is no doubt related to the fact that a move is underway in the U.K. to take the CEGB private and there are concerns that no one will want to buy the national electrical grid if it is believed to cause cancer. Tom Mangold, the reporter for *Panorama's* "Electricity – A Shock in Store," presents an overview of his thinking in an article, "The Killing Fields," in the March 24 issue of *The Listener*.

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There is continuing comment on Dr. Ken Foster and Bill Pickard's proposal to put an end to research on hazards associated with non-ionizing radiation (see *MWN*, January/February 1988). Writing in the May 5 issue of *Nature*, French researcher Dr. Janine Perre endorses their view. Perre, who has collaborated on 50 Hz electric field studies with scientists from Electricité de France, the French utility, wonders if the editors and reviewers of major scientific journals have a tinge of ambivalence "when confronted with a manuscript dealing with possible dangers of industrial agents, an ambivalence arising perhaps from a fear of being accused of selling out to international capitalism." Look for more letters in future issues of *Nature*.

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The report of the Canadian Working Group on Electromagnetic Fields, due to be released in February, is still not out. The group was formed after union officials raised concerns over health risks associated with ELF fields (see *MWN*, November/December 1986 and May/June 1987). The report

has been held up by a host of procedural and bureaucratic delays, according to the group's chair, Dr. Maria Stuchly of the Canadian Radiation Protection Bureau. But she said that the report will be released at the end of the summer.

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Here is the latest on Florida's power line siting rules. Following the April 14-15 meeting of the Environmental Regulation Commission, the state Department of Environmental Regulation (DER) proposed EMF standards at the edges of rights-of-way: 1.5 kV/m for the electric field and 50 mG for the magnetic field, under average load conditions, and 100 mG under maximum loadings. These limits are essentially the same as those recommended by the Florida EMF Advisory Panel last year (see *MWN*, November/December 1987). A public workshop has been scheduled for June 7, and another will be held in July. The standards will apply only to new power lines. "Old lines will operate as they are," DER's Buck Oven said. This would save a lot of retrofitting because, as Oven pointed out, the vast majority of the existing 500 kV lines do not now conform to these limits; nor do more than half of the existing 230 kV lines. Even some of the 138 kV lines do not comply. Under the current schedule, final rules could be adopted in October but, as Oven indicated, the date they would take effect is another issue still to be determined.

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As expected, on April 12, the New York Public Service Commission (PSC) decided to keep its power line 1.6 kV/m electric field standard (see *MWN*, March/April 1988). At the same time, the commission ordered the development of an interim magnetic field standard. The PSC also called for state utilities to participate in a technical conference to help set the magnetic field limit and to determine the magnetic fields generated by 345 kV power lines. (In its January 11 task force report, the PSC recommended setting the limit at 100 mG.) The conference, which will be open to the public, will not

consider the bioeffects of magnetic fields. As the PSC argued in an April 12 order: "The interim standard will not be directly related to biological effects," because "magnetic fields have not been shown to be hazardous and...the purpose of any standard would be to ensure that exposures to magnetic fields in future transmission line designs would be no greater than those which now exist for the many 345 kV lines operating for years throughout New York state."

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The opening plenary session at the **July Power Engineering Society meeting** in Portland, OR, will be an update on EMFs. Among those scheduled to speak are the VA's Dr. Ross Adey, HHS's Dr. John Bailar, DOE's Ken Klein and EPRI's Dr. Leonard Sagan. And this year's annual DOE-EPRI EMF research review will be held October 30-November 3 in Phoenix, AZ. The meeting is open to all and there is no registration fee. A special room rate of \$46.00 is available to attendees. For additional information on both meetings, see the conference calendar on p.15.

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The transcript from last October's Congressional hearings on *Health Effects of Transmission Lines* is back from the printer and can now be ordered. The hearing record includes both the testimony of the expert witnesses and their answers to questions posed by Rep. George Miller (D-CA), the chairman of the House subcommittee on water and power resources (see *MWN*, September/October 1987 and January/February 1988). The transcript also includes a number of interesting papers, articles and letters concerning EMF effects. Lauri Sonken, the staff aide who organized the hearings, recently left the subcommittee to return home to Los Angeles. Copies of the transcript are available for \$11.00 each from: the Superintendent of Documents, Government Printing Office, Washington, DC 20402. Specify stock No.052-070-06461-7. Visa and MasterCard orders are also accepted; call (202) 783-3238.

Wertheimer & Leeper: Adult Study Links EMFs and Cancer

A major epidemiological study does link adult leukemia and exposure to extremely low frequency (ELF) electric and magnetic fields (EMFs) at home, according to a new analysis by Dr. Nancy Wertheimer and Ed Leeper. Researchers at the Battelle Pacific Northwest Labs in Richland, WA, originally reported no association in their study, which, like the Savitz childhood study, was supported by the New York Power Lines Project (NYPLP).

Battelle's Dr. Richard Stevens found no significant increased risk of acute non-lymphocytic leukemia (ANLL) among those exposed to the greatest EMFs, as compared to controls (see *MWN*, November/December 1986). Wertheimer and Leeper believe that, in fact, the study supports their hy-

pothesis that magnetic fields are cancer promoters.

Wertheimer and Leeper have refined the Battelle analysis by taking into account the chronic use of electrically-heated beds—electric blankets, waterbed heaters and electric mattress pads—which are common sources of magnetic fields in the home. "Because Stevens's group collected extensive data on the use of these appliances, we were able to assemble a better control population—one that was unexposed to EMFs from either power lines or electrically-heated beds," Wertheimer told *Microwave News*.

Using this new control group and making other refinements, Wertheimer and Leeper reworked the Battelle data and found that the risk of leukemia increases 50-90% if an individ-

ual has been exposed to EMFs from *either* power lines or electrically-heated beds, and up to 110-260% if exposed to EMFs from *both*. When a comparison is made with those exposed to neither source of EMFs, the estimates are either borderline or fully statistically significant at the 95% confidence limit.

Wertheimer, a professor in the Department of Preventive Medicine at the University of Colorado in Denver, and Leeper, a freelance consultant based in Boulder, CO, also argue that the number of cases in Battelle's highest exposure group was too small to allow for meaningful comparisons. "When we collapsed the study's four exposure categories into 'high' and 'low' exposure groups, a positive trend emerged," Wertheimer said.

Indeed, in his report to the NYPLP, Stevens pointed out the study's limitations due to both the small sample size and the possible misclassification of exposures. "I would not rule out an association between adult leukemia and residential exposure to ELF fields on the basis of our study," he said in a recent telephone interview.

Dr. David Carpenter of the New York Department of Health, who served as the executive secretary of the NYPLP, agreed that

the issue is not closed. "There is no reason to believe that, if magnetic fields are linked to cancer, the effect is limited to children," he told *Microwave News*.

Wertheimer, Leeper, Stevens and Carpenter all support further research. "We've got to do more studies on adult residential exposures," Stevens said.

Wertheimer and Leeper argue that, if magnetic fields and cancer are causally linked, well over 25% of the ANLL cases in the Battelle study may be attributable to EMFs from high-current power lines, especially electrically-heated beds. They emphasize that exposures from appliances like electric blankets are avoidable: "*Individuals* can mitigate any cancer risk inherent in EMF exposure by altering their use."

A copy of Wertheimer and Leeper's comments is available for \$3.75 from: Charlene McAuliffe, NYS Department of Health, School of Public Health, Coming Tower, Room 2517, Empire State Plaza, Albany, NY 12237, (518) 474-7888. Make the check payable to Health Research, Inc.

States Seek Power Line Rules in Face of Federal Inaction

Interest in power line safety is heating up in state houses around the country. Eight months after Representative George Miller (D-CA) held hearings, the U.S. Congress appears reluctant to tackle the power line issue. As a result, the regulation of power line extremely low frequency (ELF) fields may follow the same path as that of radiofrequency and microwave radiation; that is, in the absence of federal rules, state and local governments will adopt their own exposure standards.

Although only one bill has made it into law – James Seward's measure in New York State – a number of proposals have been introduced in state legislatures. Here is a state-by-state review.

New York

The most specific proposal to regulate electromagnetic fields (EMFs) was introduced by Assemblyman Richard Brodsky on March 29. His bill, No.10427, would require that:

- No new residential building be built within 25 feet of an above-ground power line, or within 50 feet of a 23 kV or greater line;
- No new above-ground power line be built within 25 feet of a residential building;
- No new 23 kV or greater above-ground power line be built within 50 feet of a residential building;
- No new power line or residential building be built such that a power line magnetic field of 2.5 mG or greater is present anywhere in the residence.

The exposure levels were derived from the Savitz study, according to Mike Ettlinger, a legal advisor to Brodsky. "There's enough science there to create a strong suspicion that a real problem [exists]; in the meantime, we shouldn't be building new facilities that are likely to prove harmful," Ettlinger told *Microwave News*.

The bill has been forwarded to the Assembly's Corporations Committee, where it awaits a hearing.

Under a law passed in July 1987, the Public Service Commission cannot grant a certificate of construction or operation to a major utility transmission facility unless it determines that the facility has the minimum environmental impact on agricultural lands, wetlands, parklands and river corridors. The bill, No.1947-A, was sponsored by Senator James Seward.

Rules to limit workers' access to within ten feet of high-voltage power lines were proposed by Senator James Lack. As of early May, Lack's bill, No.7782, which would exempt power line construction and maintenance work, was on hold pending "additional amendments."

Under a bill, No.8831, introduced by Assemblyman Gordon Burrows, whenever possible, utilities would have to locate high-voltage power lines on state-owned lands – specifically, highway rights-of-way. The bill has passed the Assembly's Energy Committee and is now before the Rules Committee. A companion measure has been introduced by Senator Guy Vellela.

California

The Public Utilities Commission (PUC) and the Department of Health Services would conduct a joint study of cancer and any other health risks associated with EMF exposure from power lines, under a proposal introduced by Senator Herschel Rosenthal.

A spokesman for Rosenthal said that the purpose of the

proposal, No.2519, is to "make sure that the state has an independent evaluation of EMF health risks," and that it does not have to rely on studies sponsored by power companies. The bill would require all state utilities with operating revenues of \$25 million or more to contribute to a newly created EMF study fund – the total collected could not exceed \$2 million. A status report would have to be filed by December 1, 1989.

The bill was prompted by the report from the New York Power Lines Project. The legislature felt that, in light of the Savitz study, it should take some action to establish whether exposure to EMFs produced by power lines presents an "unreasonable cancer risk," and whether regulations are needed to curb that danger, an aide to Rosenthal told *Microwave News*.

Supporters of the bill include the American Cancer Society, the International Brotherhood of Electrical Workers and the Parent Teachers Association. The PUC is also in favor of the proposal, arguing that more evidence – refuting or confirming the health risk – is needed before imposing the costs associated with implementing EMF rules.

The senate's Committee on Energy and Public Utilities approved the bill unanimously on May 3 and forwarded it to the Appropriations Committee.

The PUC is getting ready to start a survey of the status of current EMF research and future research needs. The governor has allocated \$100,000 in his 1988-1989 budget for this effort, which is scheduled to begin this summer.

Washington State

Municipally-owned utilities would have to bury those parts of power lines of 200 kV or more that extend beyond city

limits, if the population density is at least 100 people per square mile and if the lines pass within 2,000 feet of any residence, according to bill No.6110, introduced in January by Republican Senator Eleanor Lee. The bill was prompted by complaints from residents living outside city limits, who currently have little control over municipal utilities.

The bill received a public hearing in the Senate Energy and Utilities Committee but, as a result of the cancellation of a local utility's plans for a 230 kV line, did not come up for a vote. Instead, the committee called for an interim study on ELF health risks. Lee told *Microwave News* that she plans to introduce a revised version of her bill in the next session, which begins in January 1989.

Another proposal, which also did not emerge from committee, would have prohibited state utilities from erecting high-voltage (in excess of 200 kV) electric transmission lines unless there was "no reasonable doubt that the health and safety of the persons working or residing in the area...are adequately protected." This bill, No.6421, was introduced by Democratic Senator Phil Talmadge.

Fran Raney, an aide to Senator Lee, said that Lee's and Talmadge's bills may be combined in the future.

Virginia

Since 1985, the Virginia legislature has required an annual report on the health effects of high-voltage transmission lines (see *MWN*, May 1985 and January/February 1986). The reports, prepared by the Department of Health and the State Corporation Commission, summarize recent studies on power line safety. The third annual report, issued in October 1987, concludes that, "There is a paucity of data to indicate that...

State Guidelines for Siting Power Lines and Schools

The Klein (Texas) School District lawsuit against Houston Lighting & Power Co. has focused much attention on the siting of schools near power lines and vice versa. Now, the California Department of Education has proposed what may be the first state guidelines addressing this issue.

The interim policy of the department's School Facilities Planning Division was prompted by studies on both electromagnetic fields (EMFs) and corona effects. It calls for a minimum distance – which varies according to a line's voltage – between the edge of a school's property and the edge of a right-of-way (ROW):

- 100 feet from a 100-110 kV ROW
- 150 feet from a 220-230 kV ROW
- 250 feet from a 345 kV ROW

Other factors that are considered include the possibility that a utility might later increase the voltage or expand a line, as well as non-power line issues.

According to Dr. Bruce Lowrey, a consultant to the planning division, the separation distance used to be a minimum of 400 feet, but the policy was relaxed after reviewing data from the Electric Power Research Institute and from the IEEE Power Engineering Society.

Meanwhile, in Florida, Senator Don Childers has introduced a bill which would stipulate a minimum distance of 400 feet between a school and the edge of a power line ROW. The bill, No.1165, which is patterned after California's original policy, has passed the Education Committee and is now before the Natural Resources Committee.

An aide to Childers told *Microwave News* that the senator is pushing hard to get the measure approved. CEASE (Citizens Endorsing A Safer Environment), a Boca Raton-based action group opposing the siting of a local school within 230 feet of two existing 230 kV power lines as well as one 138 kV line, is also pressing for the bill's passage.

electromagnetic fields...can propagate an adverse pathological effect...in humans."

For a copy of the 1987 annual report, contact: Dr. Khizar Wasti, Bureau of Toxic Substances, Department of Health, James Madison Bldg., 109 Governor St., Room 918-922, Richmond, VA 23219.

Measurement Roundup

• The Magnetic Fields Task Force associated with the IEEE Power Engineering Society (PES) released its report, *Magnetic Fields from Electric Power Lines Theory and Comparison to Measurements*, at the society's annual meeting the first week of February.

Among the conclusions of the report are:

The location of the return current (not if it exists but where it exists) is the most crucial influence on the magnitude of the magnetic field of the power system in areas where human exposure is most likely. The closer physically that this current is to the power line, the less the magnetic field at ground level.

Buried pipes often carry sufficient 60 Hz current to substantially change the ground level magnetic field.

The magnetic fields near distribution lines may be comparable to or even larger than the magnetic fields near overhead transmission lines. [emphasis added]

The magnetic fields of buried cables may exceed those of an overhead power line carrying the same currents. This is because the earth is not a good magnetic field shield at 60 Hz.

The principal authors of the report are: Rod Baishiki of Pacific Gas and Electric Co., Dr. Don Deno of General Electric (GE) and Dr. Robert Olsen of Washington State University in Pullman. The task force is an offshoot of the AC Fields Working Group, which in turn is part of the Corona and Field Effects Subcommittee of the Transmission and Distribution Committee.

A copy of the report (88 WM 078-8) is available for \$3.00 (IEEE members), \$6.00 (nonmembers), prepaid, from: Single Publication Sales Dept., IEEE Service Center, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855.

• A team of Swedish researchers has found that the 50 Hz magnetic fields in Swedish residential housing agree with the results found by U.S. teams in Colorado and Washington state and by English studies. Dr. Kjell Hansson Mild of Sweden's National Institute of Occupational Health in Umea told *Microwave News* that his results, based on both short-term measurements in 54 homes and 24-hour readings in 20 residences, are consistent with the previous work.

According to a report in the institute's newsletter (dated 3/87), the measurement project found that "in most residences" the magnetic field is less than 0.1 μT and that fields greater than 1 μT are "found only in exceptional cases" – and that, "In cases where the residence is close (<50 m) to a power line carrying a high current, the externally-generated mag-

netic field will be the dominant contribution to the general magnetic field levels in the residence."

• The International Electrotechnical Commission (IEC) has issued a new standard, *Measurement of Power-Frequency Electric Fields*, which covers instrumentation, calibration and field strength determination.

Written by the IEC High-Voltage Testing Techniques Committee (No.42), the document includes an appendix on "Parameters Affecting Accuracy of Field Strength Measurements."

Copies of the 45-page standard (IEC 833: 1987), which is in English and in French, are available for \$38.00 each from: Sales Department, American National Standards Institute, 1430 Broadway, New York, NY 10018, (212) 642-4900. All orders must be prepaid.

• The electric fields from different types of 345 kV power lines can vary considerably. "Each type has its own footprint," Dr. David Bruening of the Omaha Public Power District told *Microwave News*. In general, he said, "The higher the conductors, the lower the ground-level electric field."

In a paper in the October 1987 issue of *Right of Way*, Bruening compared the measured and calculated fields from four types of 345 kV structures: lattice towers, tubular H-frames, wooden H-frames and single steel poles. And he found that the maximum fields for a wooden H-frame are approximately 40 feet from the center of the structure, but that they are at the center of the line for the lattice tower and for the single steel pole.

In general, there was good agreement between the measured and calculated values – usually within 5%, with a maximum difference of 15-20%, Bruening said. The electric fields were calculated with a program devised by the Bonneville Power Administration. Bruening added that the calculations were in the process of being repeated using EXPOCALC, developed by the Electric Power Research Institute (EPRI).

Right of Way is published by the International Right of Way Association, 9920 La Cienega Blvd., Suite 515, Inglewood, CA 90301, (213) 649-5323.

• EPRI has released an expanded version (2.1) of EXPOCALC – which allows users to predict exposures to magnetic, as well as electric, fields.

The program operates on IBM PC-compatible microcomputers. EPRI is already planning the next version of the program, which will permit analysis of multiple AC lines in the same right-of-way.

For more information, contact: EPRI's Office of Special Projects, (415) 855-2974.

EPRI's Dr. Stanley Sussman, who is the project manager for the development of EXPOCALC, has written an article in the March 1988 *EPRI Journal* on "Electric and Magnetic Field Exposure Assessment," which provides information on the EXPOCALC software as well as on Emdex, a small instrument worn on the body that measures and records field strengths and

then displays the data on a PC.

- GE's Don Deno, who designed and built the prototype of the Emdex measurement system and originated the leading 60 Hz meter (the "Deno Meter"), has just started marketing an inexpensive 60 Hz magnetic field sensor.

The Model 116 can be plugged into any standard digital multimeter – such as the 3.5 digit Fluke 8020 or the 4.5 digit Fluke 8060. It can also be used to measure magnetic fields from 0.01 milligauss to 25 gauss.

The Model 116 costs \$77.00 (including shipping and handling). Contact: Electric Field Measurements, PO Box 326, Rt. 183, W. Stockbridge, MA 01266.

- Integrity Electronics & Research Co. is marketing a 60 Hz magnetic field dosimeter. The portable battery-powered 3"x4"x7" unit can measure fields from 1 microgauss to 2 gauss – on four scales – with a $\pm 2\%$ accuracy in any range. It has an LCD digital readout, with an 11 Hz bandwidth from 55-66 Hz.

Tom Valone, Integrity's president, told *Microwave News* that demand for the new unit, No. IER-109, is surpassing production and that the company has over \$10,000 in backlogged orders – without any advertising. He added that Integrity is in the midst of planning a large-scale marketing effort in North America and in Europe.

The dosimeter costs \$350.00 and is available from: Integrity Electronics & Research Co., 558 Breckenridge St., Buf-

falo, NY 14222, (716) 886-6985. The company also markets an ELF spectrum analyzer (\$2,700.00) and a charge amplifier/ion current meter (\$275.00).

- EPRI is sponsoring a seminar on *Power-Frequency Electric and Magnetic Field Exposure Assessment*, October 12-14 at the Red Lion Inn in Colorado Springs, CO. The current seminar fees are \$125.00 for EPRI members and \$600.00 for non-members. Fees go up on August 1 and no registrations will be accepted after September 15.

The seminar will feature technical sessions, panel discussions and exhibits. For more information, contact: Robert S. Banks & Associates, PO Box 14574, University Station, Minneapolis, MN 55414, (612) 623-4646.

- Virginia Electric Power Co. (VEPCO) has turned a 27-foot recreation van into a mobile electromagnetic compatibility (EMC) lab for dealing with power line interference. The utility outfitted the van, which includes a 30-foot telescopic rooftop mast, with \$200,000 worth of equipment from Electro-Metrics of Amsterdam, NY.

The van will help the utility address interference to television reception. VEPCO will be able to measure power line fields before, during and after the construction of a transmission line. The equipment can even record television programs in specific locations to document the quality of reception.

According to a spokesman for Electro-Metrics, 25 utilities have bought similar equipment – without the van.

HIGHLIGHTS

DOD Shuts Down EMP Simulators

The Department of Defense (DOD) has shut down many of its electromagnetic pulse (EMP) simulators pending the completion of environmental assessments. The move was dictated by a legal agreement to settle a year-old suit filed by the Foundation on Economic Trends, an environmental group based in Washington, DC, under the leadership of Jeremy Rifkin.

Under the May 13 agreement, approved by U.S. District Court Judge John Garrett Penn, the U.S. Navy will stop using its first EMP simulator for ships (EMPRESS I) and the U.S. Army will stop using its EMP simulators at the Harry Diamond Labs in Virginia, at the Redstone Arsenal in Alabama and at the White Sands Missile Range in New Mexico until they meet the requirements of the National Environmental Policy Act (NEPA). NEPA dictates the preparation of environmental impact statements (EISs) for "major federal actions."

In addition, while the Navy assesses the environmental impact of its TACAMO EMP (TES) and NAVES II simulators at the Naval Air Station in Patuxent River, MD, the electro-

magnetic fields (EMFs) from their operation must be less than 1 kV/m at the boundaries of the facilities.

The 1 kV/m limit is a compromise that neither Rifkin nor the DOD endorses: The agreement states that Rifkin does not accept it "as a verified standard adequate to protect either public health or the human environment," while the DOD holds that the 1 kV/m limit is "extremely conservative and has been used only as a settlement tool."

The agreement also stipulates that the Army will no longer simultaneously operate its Repetitive EMP Simulator (REPS) and the Army EMP Simulator Operations (AESOP) units at the Harry Diamond Labs in Woodbridge, VA.

Negotiations toward the settlement of Rifkin's suit (see *MWN*, March/April 1987) began in April after motions were filed to interview two civilian employees of the Diamond labs. Sources told the *Washington Post* (May 10) that the two environmental specialists would have testified that they had repeatedly warned their Army superiors that an environmental assessment was needed and that important documents had

HIGHLIGHTS

been suppressed.

The *Post* also reported that, according to three unreleased reports prepared for the Army by the BDM Corp. of McLean, VA, EMPs can knock out the electronic landing systems on commercial airliners and can cause human health problems.

Under the agreement, the DOD will pay Rifkin's group more than \$31,000 in attorneys' fees.

In other EMP-related news:

- Patricia Axelrod is expected to appeal an April 29 decision dismissing her contention that EMFs from EMPRESS II pose a detonation risk to ordnance. Axelrod had earlier filed a separate suit seeking the preparation of an EIS on hazards of electromagnetic radiation to ordnance or "HERO" from all types of EMFs (see *MWN*, September/October 1987). That suit is pending.
- The Navy has released the final EIS for EMPRESS II. For

more information, contact: Ronald Dudley, Installations Planning Division, Naval Facilities Engineering Command, Norfolk, VA 23511, (804) 445-2306.

- Under the DOD's fiscal year (FY) 1988 appropriations, the Navy is barred from using EMPRESS II in the Chesapeake Bay until the Secretary of Defense certifies that its use is "essential to the national security" and that its economic, environmental and social costs in the bay are "far less" than elsewhere. On May 10, the U.S. Senate approved an amendment to the DOD's FY89 budget which would extend this prohibition. A similar bill will be introduced in the House.

Ailing FAA Technician Fights for Workers' Compensation

Eugene Shrouf, a former Federal Aviation Administration (FAA) technician who alleges that prolonged exposure to microwave (MW) radiation is responsible for his brain tumors and endocrine problems, is fighting a drawn-out battle with the Department of Labor (DOL) for workers' compensation.

In August 1986, the DOL's Office of Workers' Compensation Programs ruled that Shrouf had failed to prove that microwave exposure caused his health problems. Shrouf, now 66 years old, is seeking a review of the decision based on more recent data.

In a February 17 letter of support for Shrouf's claim, Dr. Samuel Milham, an epidemiologist at the Washington State Department of Social and Health Services, states that, "It is my opinion that [Shrouf's] present status is a result of exposure to [VHF, UHF and MW] radiation received while in the employ of the FAA." Milham cites the long-term exposure study at the University of Washington in Seattle as an indication that endocrine tumors are associated with long-term exposure to microwave radiation, and he refers to his own research showing that brain tumors are "more common than expected in the electrical trades."

For more than a decade, Shrouf and two other technicians, Andrew Loesch and Ervin Kreisler, worked together at an FAA facility in Albuquerque, NM, repairing, adjusting and maintaining VOR, TACAN and ILS equipment (see *MWN*, May 1985). According to Shrouf, all three came very close to radiating antennas, often taking readings from less than 12 inches away. (TACAN stands for "tactical air navigation" and operates at 0.962-1.024 GHz and 1.151-1.213 GHz. VOR and ILS are short for "very high frequency omni-range" and "instrument landing system," respectively.)

Loesch and Kreisler also suffered from cancer and endocrine problems. Like Shrouf, they too were denied workers' compensation. Both are now dead.

Kreisler was diagnosed as having prostate cancer. After surgery and radiation therapy, he developed cardiac problems and ultimately bone cancer. Loesch had brain tumors, among many other ailments.

Broadcasters' Compliance Costs for RF Rules Revised

The Tax Reform Act of 1986 has increased the broadcast industry's potential costs for compliance with a radiofrequency (RF) exposure standard by 30-40%, according to an analysis for the Environmental Protection Agency (EPA).

The revised cost for television and FM radio broadcasters to meet a 100 $\mu\text{W}/\text{cm}^2$ standard and for AM stations to meet an 87 V/m limit would be \$47.6 million. With standards of 200 $\mu\text{W}/\text{cm}^2$ and 275 V/m, the cost would be \$30.9 million, while with limits of 1,000 $\mu\text{W}/\text{cm}^2$ and 614 V/m (the American National Standards Institute guidelines), the cost would be only \$16.1 million. The three sets of options were proposed by the EPA in 1986, together with a fourth option - not to regulate RF radiation (see *MWN*, July/August 1986).

The revised estimates were requested by the National Association of Broadcasters at a 1986 hearing on the EPA options. The analysis was done for the EPA by Jack Faucett Associates of Bethesda, MD. The original analysis was performed by the Lawrence Livermore National Laboratory (see *MWN*, September/October 1985).

The two principal reasons for the increased costs are the tax law's devaluation of corporate business deductions due to the reduced corporate tax rates and the elimination of the investment tax credit, according to the Faucett report.

For more information on *An Estimate of the Potential Costs of Guidelines Limiting Public Exposure to RF Radiation from Broadcast Sources: Amendments Following the Tax Reform Act of 1986*, contact: EPA's Norbert Hankin, Office of Radiation Programs (ANR-461), 401 M Street, SW, Washington, DC 20460, (202) 475-9630.

Of the three, Shrouf considers himself to be "the lucky one." After surgery to remove a benign brain tumor – a pituitary adenoma – he now suffers from hypothyroidism and adrenal damage. He requires daily doses of steroids.

During his 14 years as an FAA technician, Shrouf estimates that he was exposed to over 25,000 hours of microwave and other types of radiation. He told *Microwave News* that neither he nor his coworkers were ever informed about potential radiation hazards. In 1983, however, after the three had retired, the FAA issued a "safety memo" which warned personnel to "avoid direct contact with the TACAN radome and limit the duration of maintenance work in close proximity to the antenna while the TACAN is transmitting." Shrouf insists that although the agency claims to have issued previous safety memos, this was the first warning he had ever received and that the FAA has failed to come up with any indication that such memos ever existed.

Dr. Ira Kaplan, a board certified internist who reviewed Shrouf's claim for the FAA, states "unequivocally" that Shrouf's condition was not related to his employment – contrary to a report by a family practitioner, Dr. Karl Robinson, who told the FAA that he was "convinced" that Shrouf's tumor was caused by occupational radiation exposure.

In the 1970s, two TACAN technicians working at the Naval Air Rework Station at Quonset Point, RI, developed pancreatic cancer and other endocrine disorders. One of the men, Robert Engell, filed a \$4.5 million lawsuit against a number of electronics companies. The suit was later settled out of court (see *MWN*, January/February 1983).

Cape Cod Cancer Study Will Include EMFs

The Boston University (BU) School of Public Health will study the possible association between environmental factors – including high- and low-frequency radiation from PAVE PAWS radar and power lines – and elevated cancer rates on Cape Cod, under a \$500,000, two-year grant from the state of Massachusetts.

The announcement of the study closely follows the April 21 release of an exploratory survey, *Analysis of Lung Cancer Mortality in Females and Leukemia Mortality in Males and Females for the Towns of Barnstable, Bourne, Falmouth, Mashpee, and Sandwich, 1969-1985*, by the Massachusetts Department of Public Health, which documents a higher death rate among long-term (15 years or more) Upper Cape residents and a possible link to environmental exposures. BU's "Phase II" study is intended as a comprehensive follow-up.

Dr. Ann Aschengrau of the Department of Epidemiology and Biostatistics at BU's School of Public Health, one of the study's principal investigators, told *Microwave News* that her group will look at water and air pollution, radiofrequency radiation from the U.S. Air Force's PAVE PAWS radar and extremely low frequency (ELF) fields from power lines. The study, which will include a 25-year residential history of 3,000 local inhabitants, will also consider data on "confounders," such as diet and alcohol and tobacco use.

FROM THE FIELD

Henhouse PMF Project: Communiqué from Madrid

Reprinted below is a communiqué released following a meeting of the Henhouse Project researchers, who are investigating the effects of weak pulsed magnetic fields (PMFs). They met in Madrid, Spain, April 25-29 (see MWN, March/April 1988). In addition to Dr. Jocelyne Leal and her collaborators – Drs. L. Chacon, K. Shamsaifar, M. Trillo and A. Ubeda – at the Ramon y Cajal Hospital in Madrid, those in attendance included: Dr. Ezra Berman of the Environmental Protection Agency (EPA), Research Triangle Park, NC; Dr. Barbara Koch of the University of North Carolina, Chapel Hill; Dr. Alexander Martin of the University of Western Ontario, London, Canada; Dr. Kjell Hansson Mild of the National Institute of Occupational Health, Umea, Sweden; Jack Monahan of the Food and Drug Administration, Rockville, MD; Dr. Tom Rozzell of the National Research Council, Washington, DC (and formerly with the Office of Naval Research); and Richard Tell of Richard Tell Associates, Inc., Las Vegas, NV.

A group of investigators from six laboratories in Canada, Spain, Sweden and the United States met in Madrid from April 25-29 (sponsored by the Spanish Ministry of Health) to discuss the results of their recently completed investigations. The purpose of this set of

experiments known as Project Henhouse was to examine the effects of weak low frequency, pulsed magnetic fields (PMFs) on early embryonic development of the fertile chicken egg. The project was initiated in 1984 under the auspices of the U.S. Office of Naval Research to further examine the reports from the laboratory of Dr. Leal at the Ramon y Cajal Hospital in Madrid that exposure to pulsed magnetic fields could cause developmental abnormalities.

Each of the six laboratories participating in Project Henhouse was equipped with identical exposure and incubation equipment that had been specially designed and subsequently calibrated by the U.S. Environmental Protection Agency for these studies. Each laboratory then conducted a series of replicate exposures of 20 eggs (10 treated/10 control) for the first 48 hours of incubation. The treated eggs were exposed to a PMF having a repetition frequency of 100 pulses per second. Following the 48-hour exposure, all embryos were evaluated for maturity and morphology.

Two of the six laboratories demonstrated a significant increase in the incidence of developmental abnormalities. Three of the remaining four laboratories had more abnormal embryos in the treated than in the sham group. When the data from all laboratories were combined, a significant increase in developmental abnormalities from

FROM THE FIELD

exposure to low-level PMFs was found. While every attempt was made to have identical conditions in each laboratory, some variables could not be controlled, and differences in the results between laboratories were observed. On the basis of all their results, the investigators in Project Henhouse have concluded that exposure to weak PMFs, under certain conditions as yet undefined, can cause significant developmental abnormalities in the chicken embryo.

Using different PMFs, previous studies have reported similar findings, but several other studies have not observed this effect. There is now substantial evidence that the effect is real, but may be influenced by uncontrolled variables in addition to the PMF.

It is important to note that extrapolation of the results of Project Henhouse beyond the chicken embryo and the exposure parameters of this study is very difficult at the present time. However, there are reports about biological effects of exposure to weak alternating magnetic fields with various waveforms, thus indicating that it might not

be the pulse form as such that is the most important parameter. Other parameters such as intensity, pulse repetition frequency, fluctuations in intensity, or other variables may be more significant for production of these biological effects. Therefore, dose-response relationships which are normally used for extrapolation cannot be used until the critical parameters are known. The question the scientific community should now focus on is not whether weak electromagnetic fields affect development but rather, how they affect it. On the basis of the findings of this and other studies, further research is warranted.

During the meeting in Madrid, a draft manuscript of Project Henhouse was prepared and will be submitted for publication in the near future. The results of these studies will be presented at a scientific meeting in June. In addition, preliminary protocols for future work of the group were developed. These protocols will be finalized over the coming months and submitted to potential sponsors for funding.

UPDATES

BIOLOGICAL EFFECTS

EPA's RF/MW Report...Dr. Joe Elder, who, with Dr. Dan Cahill, edited the 1984 EPA report on the *Biological Effects of Radiofrequency Radiation*, has prepared an update based on the literature available through May 1987. The 1984 report was designed to be the basis for the agency's long-delayed RF/MW radiation guidance. Elder does not cover cancer in this new review. The 1987 conclusion differs little from the earlier one: the threshold for bioeffects is about 1 W/Kg (see *MWN*, January/February and December 1984). Here is how Elder sums it all up: "Exposure to RF radiation causes biological effects at SARs above and below 1 W/Kg; some of the effects which occur at about 1 W/Kg may be significant under certain environmental conditions. The biological significance of the effects which occur at SARs below 1 W/Kg, including those which occur at specific temperatures different from the physiological temperature range, specific frequencies or at specific amplitude-modulation conditions, is not established." For a copy of *A Reassessment of the Biological Effects of RF Radiation: Non-Cancer Effects*, contact: Dr. Joe Elder, MD-74, Health Effects Research Lab, EPA, Research Triangle Park, NC 27711.

Sunlight Activates HIV...A number of chemicals and viral agents can enhance the gene expression of HIV, the virus responsible for AIDS. Now, an international group of researchers has found that UV and even ordinary sunlight can also enhance HIV activity. In the May 5 issue of *Nature* (pp.78-81), the team goes further, concluding that their work "raises the possibility that the virus can be activated by direct sunlight."

COMMUNICATIONS

FM and TV Radiation...A researcher at the Finnish Center for Radiation and Nuclear Safety in Helsinki has devised a

simple model for predicting the power density near television and FM radio transmitters and has verified it with measurements. Dr. Kari Jokela estimates that the power density is typically less than 1 mW/cm² at about 40 meters from 10 kW (input power) UHF-TV antennas, 30 meters from 20 kW FM radio antennas and 15 meters from 4 kW VHF-TV antennas. For details, see Jokela's paper in the May 1988 issue of *Health Physics*.

COMPATIBILITY & INTERFERENCE

Ambulance Strobe EMI...An ambulance's flashing light can interfere with the operation of an onboard cardiac-monitor, according to a letter in *The New England Journal of Medicine* (March 3, 1988). It seems that on the way to the hospital, a 65-year-old woman with heart palpitations began to show abnormal "flutters," although her vital signs were unaffected. The paramedic team noted that the monitor showed an abnormal rhythm only when the ambulance's Opticon strobe, which can turn traffic lights from red to green, was turned on and the woman's hands were touching the metal railings of the patient cart. They soon found that the flutters occurred at the same rate at which the strobe flashed, 9-11 beats per second, as opposed to the five-per-second rate for a typical atrial flutter. The explanation that evolved is that the Opticon induces an EMF large enough to be picked up by the leads of the monitor; alternatively, the cardiac-monitor can pick up the signal from the paramedic vehicle through the cart. The local service department eliminated the EMI by insulating the patient cart.

TV Interference...The FCC's Harry Wong has developed a model to calculate EMI to TV channels 4 and 5 from other communications sources—for instance, private radio and land mobile transmitters. A copy of Wong's report, *Potential Interference from Operational Fixed Stations in the 72-76 MHz Band to Television Channels 4 and 5*, Office of Engineering and Technology Bulletin No.67, is available from

International Transcription Services, 2100 M Street, NW, Washington, DC 20037, (202) 857-3800. For further information, contact Wong at (202) 653-8159.

Protecting Ms. Liberty...Even though she is over 100 years old and has been struck by lightning thousands of times, the Statue of Liberty has suffered no significant damage. She has been protected by the natural conductivity of her copper "skin" and by the efficiency of her original protection system. During her recent restoration, JLN Violette & Associates of McLean, VA, assessed the system and found that, for the most part, only minor repairs and alterations were necessary. In the March/April 1988 *EMC Technology & Interference Control News*, a controlled circulation magazine based in Gainesville, VA, two members of the firm describe the statue's grounding system and the minor improvements they recommended, which included installing copper lightning rods on her torch.

Canceling EMI...Researchers at the California Institute of Technology in Pasadena, CA, have devised a way to measure emissions from a device, even in the presence of a relatively strong interfering signal. The technique uses two receiving antennas to set up destructive interference and thereby cancel out the corrupting EMI. NASA's Jet Propulsion Lab (JPL) sponsored the work and has applied for a patent. For more information, contact: Norman Chalfin, Manager, Technology Utilization, JPL, 4800 Oak Grove Drive, Pasadena, CA 91109. Ask for a copy of JPL Invention Report NPO-17132, dated April 1988.

MEETINGS

Gordon Conference...With all the new developments on bio-effects and mechanisms over the last two years, this summer's *Gordon Research Conference on Bioelectrochemistry* promises some lively discussions. The meeting is always very informal: everything said is off-the-record and no proceedings are published. Sessions are held in the mornings and in the evenings, leaving the afternoons free for recreation or whatever seems appropriate at the time. Dr. Betty Siskin, who is chairing the conference, has assembled an international lineup of speakers. The meeting will be held at Plymouth State College in New Hampshire, August 15-19. For more information, contact: Dr. Betty Siskin, Dept. of Anatomy, University of Kentucky, Lexington, KY 40506, (606) 257-5796.

MILITARY SYSTEMS

Burning a Hole in the Atmosphere...The use of high-power EM radiation in the upper atmosphere is raising concerns over its potential environmental impact. On August 11, 1987, Dr. Bernard Eastlund of Spring, TX, was granted a patent (No.4,686,605) for a way of heating charged particles in the earth's atmosphere with radiation in the 20-1800 kHz frequency band, which he says could result in the "total disrup-

tion of communications over a large portion of the earth." Alternatively, the system could be used to modify weather. Eastlund points out that his system "would have significant military implications, particularly as a barrier to, or confusing factor for, hostile missiles or airplanes." The patent has been assigned to APTI, Inc., a subsidiary of Atlantic Richfield. Writing in the April issue of *Physics and Society*, Dr. Richard Williams, a physicist based in Princeton, NJ, warns that Eastlund's invention "might become a serious threat to the earth's atmosphere" and that it is not known how Eastlund's ideas might be applied because two other patents concerning this same invention are classified secret. In his unclassified patent, Eastlund notes that a phased array antenna would be ideal for generating the desired signal and that the North Slope of Alaska would be a good place to test the weapon. Although a lot of energy - 10^9 - 10^{11} watts - would be needed, the capability is within the state-of-the-art. Indeed, Eastlund told Williams that "a secret project is already underway to study and implement the invention."

OVENS

Is It Dinner Yet?...3M is marketing a product which, it claims, takes the "guesswork" out of microwave cooking. The "MonitorMark Microwave Doneness Indicator" is a time- and temperature-sensitive strip which turns blue when microwaved food is "optimally" ready to serve. Each strip is customized to a given food product, taking into account variations in oven size, cooking instructions and storage temperature - all of which can affect cooking time. Originally developed to help preserve and transport temperature-sensitive vaccines, the 3M strip is currently on Armour frozen dinners. 3M foresees a huge market for the strip - the company estimates that retail sales of "microwave-able" foods already top \$21 billion a year. The company also anticipates further uses for the MonitorMark, including monitoring the temperature of products maintained in refrigerated storage, as in a supermarket or at a deli counter. For more information, contact: Colleen Foster, Packaging Systems Division, Bldg. 220-8W-01, 3M Center, St. Paul, MN 55144.

Beyond Food...Chemists at Canada's Laurentian University are using a microwave oven to speed up chemical reactions - by a factor of up to 1,000. They found that some mixtures exploded on irradiation and so they are now putting their reagents in Teflon bottles, which are transparent to the microwaves. The team's experiments are described in the May 19 *New Scientist*....Once you have finished warming up your chemicals, you can put your microwave oven to a more frivolous use: tie-dyeing t-shirts and scarves. With Micro Dye, Dylon International Ltd. of London, U.K., hopes to corner the market for the do-it-yourself Beau Brummell set. There are eight different colors and the whole process takes only four minutes. Stahlwood Mfg. Co. of Maspeth, NY, is the U.S. distributor.

PEOPLE

The Electromagnetic Energy Policy Alliance (EEPA) has a new president, Dr. Jay Brandinger of the David Sarnoff Research Center – formerly part of RCA and now a subsidiary of SRI International. He replaces Barry Umansky of the National Association of Broadcasters. Other EEPA officers include George Wilkening, a vice president of AT&T Bell Labs, and Donald Walker, a vice president of Motorola. James Carter, Jr. of Rockwell International is the treasurer and Dr. John Osepchuk of Raytheon is the secretary....Paul Wagner has transferred from EPA's Office of Radiation Programs in Las Vegas, NV, to the agency's regional office in Atlanta, GA. Wagner had taken over from Ric Tell, who left EPA to open his own consulting firm. Ed Mantiply is now the only remaining staffer working in Las Vegas on non-ionizing radiation.

STANDARDS

Finnish NIER Rules...On December 4, 1987, the Finnish Ministry of Health and Social Affairs issued a decree regulating products and installations that emit non-ionizing radiation – that is, any electromagnetic field with a frequency of less than 3,000 GHz. The Finnish Center for Radiation Safety is charged with setting safety standards. Among the devices covered by the new rules are UV lamps used for skin treatment, diathermy and hyperthermia equipment, certain types of lasers and other radiation devices designed to be used in the home. Radio and television transmitters and radars, with an average power of less than 1 kW (or a peak pulse of 100 kW), must also be inspected before being put into service. The rules became effective on January 1, 1988. An English translation of the Finnish regulations is available from: JoAnne Overman, Office of Standards Code and Information, Administration Bldg., Room A629, NBS, Gaithersburg, MD 20899, (301) 975-4037. Ask for regulation TBT/Notif.88.36.

IRPA Updates Laser Exposure Limits...IRPA's International Non-Ionizing Radiation Committee has issued some "minor" updates to its 1985 guidelines for human exposures to laser radiation. The changes appear in the May 1988 issue of *Health Physics*, pp.573-574.

TECHNOLOGY

Competing with Japan...Fusion Systems Corp., a small Rockville, MD, high-technology company, is battling with the Japanese conglomerate Mitsubishi over its patented microwave lamp system. In 1977, Fusion sold Mitsubishi Electric its system, which employs MWs to drive high-power UV lamps and is used in the production of semiconductor chips, optical fibers and many other items. Soon after, according to Fusion, Mitsubishi reverse-engineered the system and began filing numerous patents – nearly 200 over the next ten years – in an effort to overpower its smaller U.S. competitor.

Fusion says its repeated attempts at a negotiated settlement have been spurned by Mitsubishi, which demanded a worldwide, royalty-free license for all of Fusion's technology, plus substantial cash and royalty payments. Fusion, which believes that its case is not unique, claims to seek only "the right to continue marketing its own technology." On April 26, PBS ran a "Frontline" documentary which included a segment on the Fusion-Mitsubishi dispute.

VDTs

Radiation Shield...An independent Canadian researcher plans to market a device to contain radiation emissions from any standard VDT. The Ancile Protective Screen and Shroud System – essentially a Faraday cage which can hold a VDT – is designed to reduce ELF and VLF emissions and to control the buildup of electrostatic charges. Al Orr, the shield's developer, has already built ten prototypes of the unit and is now seeking venture capital for its production. He anticipates that the device will cost \$400-450 (U.S.). For more information, contact: Al Orr, Ancile Radiation Protective Systems, 3024 Countryside Drive, R.R.#4, Brampton, Ontario L6T 3S1, Canada, (416) 840-1859.

County Legislation...On May 10, legislators in Suffolk County on NY's Long Island approved a bill mandating eye care, ergonomic standards and rest breaks for VDT workers. The bill, introduced by Suffolk County Legislator John Foley, applies to businesses using 20 or more VDTs and to operators working at terminals for more than 26 hours a week. If signed into law by County Executive Patrick Halpin, beginning in January 1990, employers will have to pay 80% of the cost of employee eye exams and glasses and provide 15-minute rest breaks every three hours. In addition, the legislature will have to set up a five-member review committee to issue biennial reports on ergonomic and technological developments. Halpin, who has favored VDT rules in the past, must decide by June 9. Last year, a similar bill was vetoed by the previous county executive. Under a compromise, the legislators passed a bill which applies only to county workers.

ETC...

EM Energy News...Dr. Geoffrey Voss, who recently stepped down as the editor of IMPI's *Journal of Microwave Power*, has started his own publication, *Electromagnetic Energy Reviews*. In an editorial in the first issue, dated May 1988, Voss and coeditor Paul Fisher announce that, "Our objective is to provide you with current information, educational material and ideas in the applications of electromagnetic energy." The newsletter will address non-communication, non-military topics in the frequency range of 1 MHz to 1 PHz (10¹⁵ Hz). Subscriptions are \$32.00 (U.S.), \$40.00 (Canada) and £18 (U.K., by air mail). Contact: Voss Associates Engineering, Suite 401, 1011 Fort Street, Victoria, BC V8V 3K5, Canada, (604) 384-1021.

Dr. Irving Selikoff, the editor-in-chief of the peer-reviewed journal and a world-renowned specialist in occupational health, called the Goldhaber findings "worrisome." He said that, "There have been warnings that we now live in a world flooded with non-ionizing radiation, the long-term effects of which are largely unstudied. Some of the most serious potential effects are reproductive hazards; the last ten years have seen hints that these may occur with VDT radiation." Selikoff is at the Mount Sinai School of Medicine in New York City and has been seeking funds for a VDT-pregnancy study (see *MWN*, June 1985 and May/June and September/October 1987).

Dr. Michele Marcus, also at Mount Sinai, who is collaborating with Selikoff, said that the Kaiser study is "important" and that it "makes it clear that this issue needs further investigation."

Over the last few years a number of other epidemiological studies have suggested a link between VDT work and adverse pregnancy outcomes. In each case, the results were not clear-cut and the authors dismissed the pregnancy risk:

- Sweden's Drs. Anders Ericson of the National Board of Health and Social Welfare and Bengt Kallen of the University of Lund uncovered a statistically significant, dose-dependent association between VDT work and birth defects, but they cautioned that they were unable to separate VDT exposure from other variables, such as smoking and stress (see *MWN*, July/August 1986).

- Dr. Peter Westerholm of the Swedish Trade Union Confederation reported an increase in congenital malformations – especially of the heart – among the offspring of some VDT operators, but the trend did not follow a dose-response relationship (see *MWN*, July/August 1986).

- Dr. Kari Kurppa of the Finnish Institute of Occupational Health in Helsinki also reported an increase in cardiovascular abnormalities among the children of part-time VDT workers (see *MWN*, January/February 1985 and March/April 1986).

- Dr. Alison MacDonald of the Institut de Recherche en Santé et en Sécurité du Travail du Québec in Montreal, Canada, found an increased risk of spontaneous abortions among part-time – but not full-time – operators. She attributed the finding to recall bias (see *MWN*, July/August 1986).

- Drs. Bill Butler and Kelley Brix, formerly of the University of Michigan in Ann Arbor, found a slight but not significant number of spontaneous abortions among women who used VDTs more than 20 hours a week (see *MWN*, September/October 1986).

After reviewing most of these studies, the Kaiser team concludes that even though the increased risks of adverse pregnancy outcomes were small, "consistent evidence across studies provides some basis to suspect that an excess risk could be real."

Goldhaber and coworkers' survey of 1,583 pregnant women indicates that the risk for both early (less than 12 weeks) and late (12 weeks or more) miscarriages increased approximately 80% for all women who worked on VDTs more than 20 hours a week, as compared to women who did similar work without VDTs. There was a 100% increase in miscarriages when the VDT operators were compared to non-working women. There

was no statistically significant increase in risk for women who used VDTs less than 20 hours a week.

For administrative support and clerical workers, a subgroup of the study population, the miscarriage risk was 240% that of the rate for non-exposed workers in the same category. This finding is statistically significant.

The number of birth defects was too small to support a statistically significant link at any level of exposure, although the Kaiser team did find a 40% increase for both moderate (5-20 hours a week) and heavy (more than 20 hours a week) use.

Goldhaber and coworkers warn that their VDT-miscarriage link may be exaggerated by recall bias – the overestimation by women with adverse pregnancy outcomes of their time spent at terminals. Nor can they fully discount ergonomic factors or job stress. Nevertheless, the researchers are unable to eliminate the possibility that the VDTs were responsible for the increased risk.

Study History

The Kaiser study was originally designed to investigate the possible reproductive impact of malathion, a pesticide which was sprayed in California from 1981 to 1982 to combat medflies. In the fall of 1982, prompted by a rash of reported clusters of adverse pregnancy outcomes among VDT operators, the federal National Institute of Occupational Safety and Health (NIOSH) asked Kaiser to include some questions on VDT use in the pesticide study. After the collaboration was announced, negotiations with Kaiser broke down (see *MWN*, November 1982 and June and July/August 1983).

NIOSH finally launched a separate VDT epidemiological study, which is scheduled to be completed this fall (see *MWN*, May and December 1984, January/February 1985, January/February 1986 and September/October 1987). Meanwhile, Kaiser went ahead and included VDT questions in its malathion study.

The Kaiser epidemiological VDT study is the first seriously to consider low frequency magnetic fields. Because the highest electromagnetic fields are at the sides and at the rear of the sets – not at the front – the number of hours at a terminal may not be a reliable index of exposure and may indeed underestimate an operator's time exposed to the field. The Kaiser researchers acknowledge this and note, "Exposure can be dependent on office seating arrangements and coworkers' use of the machines. This fact, however, would only weaken our ability to detect any effect related to non-ionizing radiation." That is to say, if there is a link between problem pregnancies and VDT electromagnetic fields, then the risk is greater than suggested in this study.

In light of their findings, the Kaiser team emphasizes the need for further investigations and calls for large-scale studies of working women to provide "objective measures of VDT exposure, ergonomic factors and job stress during early pregnancy." Indeed, Mount Sinai's Selikoff stresses that, "There are few research areas that deserve more urgent priority."

fields. Such a synergistic reaction between ELF fields and a carcinogen is in itself a major finding. But for those in search of a mechanism to explain ELF effects, Leung's results – uncertain though they may be – relating melatonin and, therefore, the pineal to the promotion of cancer may be equally important.

The role of the pineal in the development – or, more precisely, in the inhibition – of hormone-dependent cancers has been well established over the last few years. In September 1987, at an *International Workshop on the Pineal Gland and Cancer* in Tübingen, West Germany, scientists reviewed the latest research; "The workshop's take-home lessons were that melatonin can inhibit tumor formation and can have a significant impact on the immune system," Wilson told *Microwave News*.

The pineal synthesizes serotonin, a neurotransmitter, which is metabolized into melatonin, which in turn is secreted into the bloodstream and the cerebrospinal fluid (CSF). Daylight suppresses melatonin production, as do stress, alcohol and EMFs. Lower levels of melatonin, the argument goes, result in an elevated risk of cancer.

EMFs also alter the balance of other neurochemicals. In 1985, Dr. Richard Seegal of the New York State Department of Health reported that 60 Hz electric and magnetic fields can lower the levels of 5-hydroxyindoleacetic acid (5-HIAA) in the CSF of primates (see *MWN*, November/December 1985). Reduced concentrations of 5-HIAA, which is a metabolite of serotonin, have been associated with depression and suicidal behavior.

Interestingly, two papers, published in 1979 and 1981, by Drs. Stephen Perry, Robert Becker, Andrew Marino and Maria Reichmanis identified an association between living near 50 Hz power lines and suicide (see *MWN*, December 1981). More recently, Perry extended his work to show that people exposed to ELF fields in high-rise apartments also are more likely to suffer from depression (see *MWN*, November/December 1987).

In the 1970s, reports from the Soviet Union indicated that workers exposed to power line fields had higher than expected rates of fatigue, irritability and headaches.

Earlier this year, a team headed by Dr. David Dowson of the U.K.'s Centre for Complementary Medicine in Southampton reported new support for the link between power line exposures and depression and headaches.

There are still many loose connections in this line of argument. Seegal himself is skeptical that his work supports a link between ELF fields and suicides. "It's a natural connection, but there are enough warning signs that the connection is tenuous at best," he said in a telephone interview from his lab in Albany, NY.

On the other hand, Perry told *Microwave News* that he thinks the link is credible and must be studied further. For his part, Becker said that he is confident that there is a relationship between depressive states and chronic exposure to ELF fields.

EMFs can shift circadian rhythms. This effect appears to

be analogous to the now well-established "seasonal affective disorders" (known as "SAD"), which are caused by shifts in pineal rhythms and which can, to a certain extent, be remedied by daily exposure to bright light.

Leung's Experiments

Leung and coworkers ran two similar experiments: Rats exposed to 60 Hz, 40 kV/m electric fields were injected with 7,12-dimethylbenz(a)anthracene (DMBA), a known carcinogen. Rats exposed to both ELF fields and DMBA had more tumors per tumor-bearing animal than those receiving only DMBA. In each case, however, the increase was not statistically significant and last November, Leung reported them as negative. But Leung told *Microwave News* that, when the data from both experiments were later combined, the increase was significant. Battelle's research on electric fields and the pineal has been supported by the Department of Energy.

Lee Rosen of W/L Associates in Frederick, MD, agreed that Leung's experiment points to the involvement of the pineal. "This may be the key to understanding how EMFs affect the body," he told *Microwave News*. "We may now have a defined, reproducible biological endpoint for monitoring the development of cancer as well as other effects."

Battelle's Dr. Richard Stevens goes even further, stating that EMF impairment of the pineal may be implicated in the observed increase in breast cancer among women in industrialized countries (see *MWN*, January/February 1987). At the Tübingen workshop, he described how alterations in melatonin rhythm by EMFs and light – among other factors – may provide a framework for interpreting mechanisms of action for hormone-related cancers. Stevens is seeking funds for an epidemiological study of breast cancer and its possible relation to electric power use.

Rosen favors extending current studies by using magnetic, rather than only electric, fields. In addition, he would like to see experiments with longer exposure periods to determine long-term impacts, if any.

The debate will continue July 25-27 in Hong Kong at a symposium on *Melatonin and the Pineal Gland*, which is an offshoot of the *8th International Congress of Endocrinology*.

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Stephen Perry, et al., "Environmental Power-Frequency Magnetic Fields and Suicide," *Health Physics*, 41, pp.267-277, August 1981.

Stephen Perry and Laurence Pearl, "Power Frequency Magnetic Field and Illness in Multi-Storey Blocks," *Public Health*, 102, pp.11-18, 1988.

Maria Reichmanis, et al., "Relation Between Suicide and the Electromagnetic Field of Overhead Power Lines," *Physiological Chemistry & Physics*, 11, pp.395-403, 1979.

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

Bary Wilson, et al., "Chronic Exposure to 60-Hz Electric Fields: Effects on Pineal Function in the Rat," *Bioelectromagnetics*, 2, pp.371-380, 1981.

Bary Wilson, "Chronic Exposure to ELF Fields May Induce Depression," *Bioelectromagnetics*, 9, pp.195-205, 1988.

Jonathan R. Wolpaw, et al. (including Richard Seegal), "Chronic Effects of 60 Hz Electric and Magnetic Fields on Primate Central Nervous System Function," *Final Report to the New York Power Lines Project*, May 12, 1987.

CONFERENCES

New Listings

July 25-27: Melatonin and the Pineal Gland, Hong Kong. Contact: Alex Tzang, Executive Director, Symposium on "Melatonin and the Pineal Gland," c/o BDG Management Ltd., East Town Bldg., Suite 705, 41 Lockhart Rd., Hong Kong, (5) 286136.

July 29-31: 1988 International Tesla Symposium, Colorado Springs, CO. Contact: International Tesla Society, 330A W. Uintah, Suite 215, Colorado Springs, CO 80905, (719) 570-0876.

September 13-16: 6th National Association of Regulatory Utility Commissioners (NARUC) Biennial Regulatory Information Conference, Hyatt Regency, Columbus, OH. Contact: David Wirick, National Regulatory Research Institute, 1080 Carmack Rd., Columbus, OH 43210, (614) 292-9404.

September 21-23: 1988 Symposium on Antenna Applications, Allerton Park, Monticello, IL. Contact: Paul Mayes, Department of Electrical and Computer Engineering, University of Illinois, 1406 W. Green St., Urbana, IL 61801, (217) 244-0543.

October 3-6: 5th Annual Electronic Imaging '88, World Trade Center, Boston, MA. Contact: Ed Martin, MG Expositions Group, 1050 Commonwealth Ave., Boston, MA 02115, (617) 232-EXPO.

October 30-November 3: DOE-EPRI Review of Research on Biological Effects of 50/60 Hz Electric and Magnetic Fields, Air Ions and Ion Currents, Hyatt Regency, Phoenix, AZ. Contact: W/L Associates, 120 W. Church St., Frederick, MD 21701, (301) 663-1915.

1989

May 23-25: IEEE 1989 National Symposium on Electromagnetic Compatibility, Radisson Hotel, Denver, CO. Contact: Dave Hill, PO Box 4056, Englewood, CO 80155, (303) 497-3472.

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

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

Upcoming Meetings

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

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

July 12-15: 4th Joint Magnetism and Magnetic Materials - InterMag Conference, Hotel Vancouver, Vancouver, BC, Canada. Contact: Diane Suiters, Courtesy Associates, 655 15th St., NW, Suite 300, Washington, DC 20005, (202) 639-5088.

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

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

August 8-12: Non-Ionizing Radiations: Biophysical and Biological Basis, Applications and Hazards in Medicine and Industry, MIT, Cambridge, MA. Contact: Director of Summer Sessions, Room E19-356, MIT, Cambridge, MA 02139, (617) 253-2101.

August 15-19: Gordon Research Conference on Bioelectrochemistry, Plymouth State College, Plymouth, NH. Contact: Dr. Betty Siskin, Department of Anatomy, University of Kentucky, Lexington, KY 40506, (606) 257-5796.

August 20-26: 7th Annual Scientific Meeting and Exhibition of the Society of Magnetic Resonance in Medicine (SMRM), San Francisco Hilton & Towers, San Francisco, CA. Contact: SMRM, 15 Shattuck Sq., Suite 204, Berkeley, CA 94704, (415) 841-1899.

August 29-31: 23rd Microwave Power Symposium, Skyline Hotel, Ottawa, Ontario, Canada. Contact: International Microwave Power Institute, 13542 Union Village Circle, Clifton, VA 22024, (703) 830-5588.

September 12-15: 18th European Microwave Conference, Folkets Hus, Stockholm, Sweden. Contact: Microwave Exhibitions and Publishers, 90 Calverley Rd., Tunbridge Wells, Kent TN1 2UN, U.K., (0892) 44027.

September 27-29: 10th Annual Electrical Overstress/Electrostatic Discharge Symposium, Marriott Hotel, Anaheim, CA. Contact: Michael Martin, 3M/Static Control Systems Division, 2111 W. Braker Lane, Bldg. 501, PO Box 2963, Austin, TX 78769, (512) 834-3117.

October 9-12: 8th Annual Meeting of the Bioelectrical Repair and Growth Society (BRAGS), Mayflower Hotel, Washington, DC. Contact: BRAGS, PO Box 64, Dresher, PA 19025, (215) 659-5180.

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