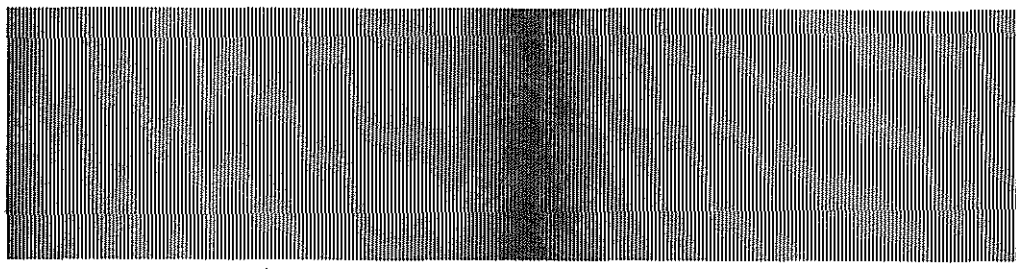


MICRO WAVE NEWS



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A Report on Non-Ionizing Radiation November/December 1987

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\$25 Million Power Line Award Reversed; Health Issue Affirmed

The Texas Court of Appeals has struck down a \$25 million award for punitive damages against Houston Lighting & Power (HL&P) for building a power line across school property without receiving proper permission. The court affirmed, however, the remainder of the jury's decision, including its conclusion that there are potential health effects associated with exposure to electromagnetic fields (EMFs) from power lines (see *MWN*, November/December 1985).

In his November 5 opinion, Judge Paul Pressler denied the \$25 million award on the legal ground that HL&P was not guilty of trespass and therefore could not be liable for punitive damages. But he overruled HL&P's contention that there was insufficient scientific basis for the jury's finding. Pressler decided that the jury had not erred when it found that there was "clear and convincing evidence" of potential EMF hazards and that HL&P had therefore abused its discretion in siting a 345 kV power line on school property.

Indeed, Pressler wrote of "the ominous implications of recent scientific research" on the health effects of power line EMFs.

Although attorneys for each side agreed with some parts of the decision, they have both filed for a rehearing, the first step towards an appeal to the Texas Supreme Court.

H. Dixon Montague of Vinson & Elkins, who is representing the Klein Independent School District, is confident that the higher court will reinstate the \$25 million award. In the interim, he is delighted with the way the court ruled on the health effects issue. "The opinion is devastating to HL&P in its future power line cases," he told *Microwave News* in a

(continued on p.14)

Congressional Hearings on Power Lines: Follow-Up Seen

"We are not going to let the issue die," a spokesman for Congressman George Miller (D-CA) told *Microwave News* following the October 6 House subcommittee on water and power resources hearing on the health effects of power lines. "We are getting calls from all over the country. We have had more follow-up calls on this hearing than on any other in a long time."

After the hearing, Miller sent a number of probing questions to each of the witnesses who had testified (see *MWN*, September/October 1987). The responses will be included in the transcript of the hearing, which will

(continued on p.10)

The Talk of Kansas City

The mood was serious at this year's DOE-EPRI review of research on the health effects of power lines in Kansas City, MO.* The meeting was as intense as a cram session before an exam. Gone was the attitude that with just a little more work the health issue would be settled and resistance to new transmission lines would evaporate.

"Everybody is getting the message that the problem needs to be looked at," DOE's Ken Klein said during a coffee break. Another longtime observer, who preferred anonymity, agreed: "They've pulled their heads out from the sand. Savitz has shocked them."

Only a year ago, at the last DOE-EPRI review, Dr. David Savitz had announced support for the proposition that extremely weak 60 Hz magnetic fields increase the risk of cancer among children. Although Dr. Nancy Wertheimer and Ed Leeper's original study was eight years old and had since been reinforced by a second study, Savitz's results somehow tipped the balance and everything changed. This year in Kansas City, some people were even talking about being in the post-Savitz era.

Any hopes that further analysis of his data would lead Savitz to change his conclusions were dashed when he announced that the association was now stronger than he had previously reported and that he could not find any "variable X" which could explain away the results (see p.4).

This new awareness has not translated into increased government support, however. Money is still tight and those researchers who have managed to stay in business up to now are no more optimistic about the future. Indeed, the DOE's 1988 budget is down 15% from its 1987 level to \$2.2 million – and that's without possible losses due to across-the-budget cutbacks mandated by the Gramm-Rudman law or by some other belt-tightening federal budget compromise. Other sources, such as the U.S. Environmental Protection Agency (EPA) and the New York State Power Lines Project, have completely dried up.

Only EPRI has pledged new money – \$3.2 million for 1988, a 15% increase over last year. And, what's more, Dr. Leonard Sagan, EPRI's point man for the utilities, does not feel constrained by his budget. It could grow larger, he said.

Much of this money will support ongoing work, but EPRI has also initiated a new basic science program. And everybody has been waiting to find out who will be among the lucky few to start new research projects; only three of the 16 proposals will be funded. Each will get support for three years – which is a long time these days.

The ability to pursue an interesting result or to follow a

hunch is a rare luxury in this field. The audience greeted Dr. Reba Goodman with a roar of approval when she digressed from her talk to remind those with the money that, "It takes two to five years to get results. Two years is not enough. We need long-term funding."

Without a doubt, it will take some time to sort out how such weak fields can cause such dramatic effects. The latest clue – Drs. Craig Byus and Ross Adey's finding that certain types of cellular activity can go into overdrive in a 60 Hz field (see p.3) was much discussed – especially since an AP report on their work was picked up by local newspapers across the country the day before the meeting.

The media are definitely onto the power line story. A reporter from a Houston, TX, television station was filming interviews in the hall outside the meeting room. And a favorite topic of conversation during the breaks centered around the proposed ABC *World News Tonight* segment on the power line controversy. (It was subsequently broadcast on November 9 – see p.6.)

Less clear is how the government will respond to public concern. The October 6 Congressional hearings came too late in Washington's budget cycle to change research agendas. It is highly unlikely that any agency will initiate regulatory action because, as EPA's Dave Janes pointed out, no single agency has been officially charged with addressing the issue. "The responsibility is too diffuse," he said.

Any agency official who musters the courage to tackle the problem will have to decide how to handle the Wertheimer-Leeper and Savitz results, which implicate 60 Hz fields on the order of a few milligauss – this is a daunting prospect for any bureaucrat who is attached to his job. Dr. Barry Wilson of the Battelle Pacific Northwest labs tried to get people to focus on the implications of the epidemiological data. "What would be the response if it turns out that David Savitz's work is true?" he asked. *No one* volunteered an answer.

Wilson's question is still an academic one to some – but not to the regulators in Florida, who in the next few months may set standards for allowable exposures along power line right-of-ways. Utilities will be watching public reaction to this forthcoming proposal closely, because if Florida citizens demand a strict cancer-based standard, it will spell trouble for the industry as a whole.

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*The Department of Energy (DOE) and Electric Power Research Institute (EPRI) *Review of Research on Biological Effects from Electric and Magnetic Fields, Air Ions and Ion Currents Associated with High Voltage Transmission Lines*, Kansas City, MO, November 2-5.

New and Forthcoming Papers on Bioeffects and Health

Byus & Adey: ODC and Cancer Promotion

Tumor cells exposed to weak electromagnetic fields (EMFs) show a marked increase in the activity of a key enzyme related to cell growth, according to studies by Drs. Craig Byus and Ross Adey. "Our experiments are consistent with the epidemiological data showing increased cancer rates due to exposure to power line fields," Byus told *Microwave News* from his office at the University of California at Riverside. Adey is at the VA hospital in Loma Linda, CA.

In a paper published in the October issue of *Carcinogenesis*, Byus and Adey report that EMFs can stimulate the activity of ornithine decarboxylase (ODC). Because ODC is essential to the growth of cancer (as well as normal) cells, the findings are consistent with the hypothesis that 60 Hz EMFs can promote cancer.

If rapidly growing cells show a burst of ODC activity, this is not necessarily an indication of cancer promotion. Many other factors can stimulate ODC synthesis. Dr. David Carpenter of the New York Department of Health, who served as the executive secretary of the New York State Power Lines Project, explained in an interview with *Microwave News* that the hypothesis is a good one, but to be totally convincing, there must be cancer at the end point, not just ODC activity. He argued that the experiment that needs to be done is one in which a leukemia-prone strain of animals is exposed to EMFs, in order to see if the leukemia rate increases.

Among Byus and Adey's key experimental findings were:

- ODC activity remained elevated up to four hours after EMF exposure stopped before later returning to normal. For one cell line (P3 mouse myeloma cells), there was no EMF effect after a one-hour exposure, but, without any further exposure, ODC activity increased to 175% of that in controls two hours later.

- A "power window" was observed in Reuber H35 hepatoma cells. A 10 mV/cm 60 Hz field induced a nearly 50% increase in ODC activity, but a 5 mV/cm field caused only a very slight increase and a 1 mV/cm exposure had no effect. A 0.1 mV/cm field induced a significant 30% increase, however.

- All cell lines tested responded to the field – though to slightly different degrees.

- H35 cells exposed to 60 Hz EMFs continuously for three hours manifested a see-saw effect in ODC activity. One hour after exposure, ODC activity was up; an hour later, activity returned to baseline levels; and another hour later, it was less than in controls. One possible implication of this finding is that, if EMFs are in fact cancer promoters, intermittent exposure to 60 Hz fields may entail a greater risk than continuous exposure.

In a second paper, submitted to *Cancer Research*, Byus and Adey report a similar increase in ODC activity in H35 cells exposed to "athermal" 450 MHz microwaves, modulated at 16 Hz. Here again, the ODC activity persisted for

several hours following a one-hour exposure. Microwaves modulated at 60 or 100 Hz had no effect, however. In addition, cells exposed to the microwaves had an enhanced response to a phorbol-ester tumor-promoting agent.

Craig V. Byus, Susan E. Pieper and W. Ross Adey, "The Effects of Low-Energy 60 Hz Environmental Electromagnetic Fields Upon the Growth-Related Enzyme Ornithine Decarboxylase," *Carcinogenesis*, 8, pp.1385-1389, October 1987; Craig V. Byus, K. Kartun, S. Pieper and W. Ross Adey, "Increased Ornithine Decarboxylase Activity in Cultured Cells Exposed to Low Energy Modulated Microwave Fields and Phorbol-Ester Tumor Promoters," submitted to *Cancer Research*. See also *MWN*, July/August 1983.

Milham: Cancer Among Radio Operators

In a new epidemiological study, Dr. Samuel Milham has found that amateur radio operator licensees have a significant excess mortality due to acute myeloid leukemia (AML), multiple myeloma and perhaps certain types of malignant lymphoma. Milham's results will appear in the January 1988 issue of the *American Journal of Epidemiology*.

Following up his 1985 study of members of the American Radio Relay League (ARRL), published in the *Lancet* as "Silent Keys," Milham matched data from the Federal Communications Commission's licensee files with death certificates in California and Washington state. He identified 2,485 deaths between 1979 and 1984 and observed a statistically significant increase in AML – standard mortality ratio (observed/expected x 100) = 176 – a finding consistent with the pattern observed among electrical workers.

Milham, who is with the Department of Social and Health Services in Olympia, WA, and who was the first to report a link between occupational exposure to EMFs and cancer, notes that the death certificates of 31% of Washington state amateur radio operator licensees list occupations with EMF exposures. Job data were not available for the California deaths.

In a telephone interview, Milham told *Microwave News* that analysis of the same data set by license class indicates that novices, who have a limited history of exposure, showed no excess mortality. This finding will be published in a later paper.

Samuel Milham, Jr., "Increased Mortality in Amateur Radio Operators Due to Lymphatic and Hematopoietic Malignancies," *American Journal of Epidemiology*, 127, January 1988, forthcoming. See also *MWN*, July/August 1982, May and July/August 1985 and March/April 1986.

Perry & Pearl: Depression in High-Rise Apts.

If the magnetic fields from distribution lines are strong enough to explain increases in childhood cancer rates, can fields from power lines in high-rise apartment buildings have any health effects? In the January 1988 issue of *Public Health*,

British researchers Drs. Stephen Perry and Laurence Pearl report finding evidence that people living near main electrical supply lines in tall buildings have higher incidences of some types of heart disease and depression.

In the early 1980s, Perry—in collaboration with Dr. Robert Becker's research group at the Upstate Medical Center in Syracuse, NY—reported a tendency towards suicide among those living near power lines. Perry retired from a career as a general practitioner in 1986, and is now pursuing research on power line health effects.

Perry and Pearl selected the hospital records of those who lived in apartment buildings nine or more stories high in the English town of Wolverhampton and then divided them into two groups—those "near" to and those "distant" from the building's power cable. Among the "near" group, there was significantly more "myocardial infarction, hypertension, ischaemic heart disease" ($p=0.056$) and "depression" ($p=0.03$), but significantly less "personality defect, anxiety, agitation, young confused" ($p=0.026$).

For apartments on the same floor of a building in which the power mains were located on one side or the other, magnetic fields were, on average, 1.54 mG higher in the "near" apartments (3.15 mG) than in the "distant" apartments (1.61 mG). The difference was as high as 2.29 mG between apartments that were the closest (3.77 mG) and those that were the farthest away (1.48 mG) from the building's power line. Contrary to

some published reports, Perry and Pearl's measurements indicated that magnetic fields were higher on the upper floors, than on the lower floors.

"The findings are not conclusive," Perry and Pearl argue, "but they clearly indicate a need for further investigation with larger samples."

Stephen Perry and Laurence Pearl, "Power Frequency Magnetic Field and Illness in Multi-Storey Blocks," *Public Health*, 102, January 1988, forthcoming. *Public Health* is the journal of the Society of Community Medicine and is published in the U.K. See also *MWN*, December 1981.

Rivas: Effects on the Second Generation

Mice exposed to 50 Hz pulsed magnetic fields (PMFs) over two successive generations showed significant decreases in body weight in the second generation, but not in the first generation, according to a new study from Dr. Jose Delgado's former laboratory in Madrid, Spain.

Dr. L. Rivas and coworkers report that the second generation mice exposed to either 83 μT or 2,300 μT , 5 millisecond PMFs showed significant decreases in weight. Because the difference in the effect at the two exposure levels was small, the team suggests that the strength of the field is "of relatively little importance." They also found significant changes in blood glucose and triglycerides only in the second generation.

Updated Savitz Study: Cancer Link on Firmer Ground

Additional data collection and analysis by Dr. David Savitz have strengthened his finding of a link between exposures to 60 Hz magnetic fields and childhood cancer. The new results, presented at the Kansas City, MO, review of power line health effects on November 4th, have removed some of the earlier ambiguities: the association is now similar for both estimated and measured magnetic fields. Also, Savitz has checked and rejected other variables that could explain away the cancer-power line link.

In his preliminary results, Savitz reported that the increased rate of childhood cancer was significantly associated only with the index devised by Dr. Nancy Wertheimer and Ed Leeper as a surrogate for long-term exposures. The increased cancer risk was more modest and not statistically significant when correlated with instantaneous measurements of magnetic fields—leading some critics to question the reliability of the findings (see *MWN*, November/December 1986).

After tracking down some of the missing exposure data and updating his analysis, Savitz has narrowed the difference to the point that he is satisfied that it is inconsequential. The association with measured magnetic fields is still not statistically significant—due to the small number of cases. But, as Savitz said in an interview with *Microwave News*,

"The discrepancy is no longer worth sorting out."

Savitz found only a weak association between measured magnetic fields and cancer when he used a 2 mG threshold for classifying the 60 Hz exposed group. When he changed the cutoff to 3 mG, the childhood cancer risk became "notably larger," though less precise, again due to the limited sample size.

Some reviewers have suggested that air pollution from vehicular traffic along major arteries which are also routes for high current distribution lines may explain the observed cancer link. In Kansas City, Savitz said that he had now examined this possibility and concluded that traffic density is not a confounding variable.

Savitz also reported that he could discern no evidence of a dose-response relationship between cancer incidence and the length of time lived near a high current power line. Dr. Nancy Wertheimer told *Microwave News* that she is "not especially surprised" by this finding, "because we are probably dealing with cancer enhancement, rather than initiation. Our and Savitz's data are both consistent with the hypothesis that the effects of the fields are fast acting."

Savitz, who is with the University of North Carolina School of Public Health in Chapel Hill, and his coauthors have submitted their results to the *American Journal of Epidemiology*.

No effects were observed on serum proteins and cholesterol.

Rivas concludes that his results are consistent with previous studies by Drs. Andrew Marino and Robert Becker and that, though they may be due to a cumulative PMF effect, they are "more probably" due to a "genetic influence on the exposed animals."

L. Rivas, M.A. Oroza and J.M.R. Delgado, "Influence of Electromagnetic Fields on Body Weight and Serum Chemistry in Second Generation Mice," *Medical Science Research*, 15, pp.1041-1042, 1987. See also *MWN*, March/April 1986.

Recently Published

- Dr. Nancy Wertheimer and Ed Leeper have extended their analysis of cancer incidence among adults living near high current power lines (see *MWN*, January/February 1983). Their paper, "Magnetic Field Exposure Related to Cancer Subtypes," appears in the *Annals of the New York Academy of Sciences*, 502, pp.43-54, 1987.
- The Battelle studies on the developmental and reproductive effects of multi-generational exposure of miniature swine and rats to 60 Hz electric fields are reported in two papers in the most recent issue of *Bioelectromagnetics* (8, pp.229-242 and pp.243-258, 1987, and see *MWN*, March/April 1986).
- Three recent papers on cyclotron resonances of calcium ions by Drs. Bruce McLeod and Keith Cooksey of Montana State University in Bozeman, Dr. Stephen Smith of the University of Kentucky in Lexington and Dr. Abe Liboff of Oakland University in Rochester, MI, have been published: two papers, one on diatoms and one on lymphocytes, in the *Journal of Bioelectricity*, 6, pp.1-12 and pp.13-22, 1987; and another on diatoms in *Bioelectromagnetics*, 8, pp.215-227, 1987.
- Dr. Philip Landrigan of the Mount Sinai School of Medicine in New York, NY, includes a discussion of "Leukemia and Electromagnetic Fields" in his paper on "Occupational Leukemia," appearing in *Occupational Medicine: State of the Art Reviews*, 2, pp.179-188, January-March 1987.

Florida Report Out; Court Ruling Makes Standards Moot

As the Florida Department of Environmental Regulation (DER) entered the final stages of rulemaking for power line electromagnetic fields (EMFs), a state court of appeals ruled that exposure standards are not legally required.

The EMF rules have been under development since early last year, after the Florida Siting Board denied the Florida Power Corp. a permit to build a 500 kV line without exposure standards (see *MWN*, March/April 1986). In 1983, the state legislature ordered EMF standards, but they were stalled by a lack of both funds and expertise within the DER (see *MWN*, July/August 1983 and July/August 1984).

In early October, the Florida EMF Advisory Panel, which was set up to guide the DER, recommended maximum EMFs

at the edge of a right-of-way of 1-2 kV/m and 50-100 mG for the electric and magnetic fields, respectively. The panel noted that the DER set only "interim" standards -- to be reevaluated in no more than three years. (The full text of the panel's recommendations is reprinted below.)

Then, on October 8th, the Florida Court of Appeal (First District) reversed the decision by the state Siting Board -- the governor and his cabinet make up the board. In *Florida Power Corp. vs. State of Florida et al.*, the three-judge panel ruled that power lines can be approved without statewide EMF exposure standards, as long as each line is evaluated on a case-

Florida EMF Panel: Recommendations

1. It would be prudent to keep the long-term exposure to the population to low values, by so far as possible routing transmission lines outside of residential areas, and where this is not possible, to limit the magnetic and electric field strengths at the edge of the right-of-way (ROW).
2. There should be an interim standard regulating electric and magnetic fields (EMFs). The interim should be for no more than three years. The maximum electric field at the edge of the ROW should be from 1-2 kV/m. The maximum electric field within the ROW should not exceed 8 kV/m. The magnetic field standard for maximum load conditions should not exceed 100 milligauss (mG) at the edge of the ROW while the limit for normal loads should be about 50 mG at the edge of the ROW.
3. It is strongly recommended that the federal government should: (1) adopt standards for electric and magnetic fields so utilities would have consistent standards nationwide, and (2) substantially increase financial support and promote research into the potential health effects of electric and magnetic fields from 60 Hz sources and encourage research into mechanisms for reducing exposures to EMFs.
4. Any state rule adopted should require utilities to design new lines for possible retrofitting of engineered controls to reduce EMFs if research should confirm adverse health effects.
5. Any rule should consider the fact that it is more important to know the effects on humans of fields from transmission lines than the true magnitude of the electric field within the human body. The magnitude of the electric field within a body may be useful in understanding any effects on that body.
6. The potential problem of EMF effects from existing distribution lines and substations should be considered after standards for new facilities are adopted and after scientific knowledge demonstrates a clear health hazard. Placement of distribution lines on clear, dedicated ROWs would allow for better protection of the public, if needed.
7. There appears to be some merit in adopting both electric field standards and magnetic field standards. Electric field standards can reduce the perception effects, shock, tingling or hair vibration, to a tolerable level and keep contact shocks to short-circuit currents to less than 5 mA. Since much research into health effects seems to be concentrated on magnetic fields, a magnetic field standard appears appropriate.
8. Little evidence has been found to indicate any synergistic effects between electric and magnetic fields.
9. The noise of transmission lines as well as mild, nuisance shocks induced by EMFs should be addressed in a rule to protect the public welfare.

ABC News Covers Power Lines

Excerpted below is ABC Television's November 9th World News Tonight report on the health effects of power lines.

ABC News:...New York state has spent six years on 16 studies to determine the effect of magnetic fields on human health. The official report concludes up to 15 percent of all childhood cancer could be the result of exposure to magnetic fields. It is the most solid evidence to date according to a top New York state health official.

Dr. David Carpenter: This may be as significant an understanding of the origin of cancer in man in the 20th century as anything that's happened since the understanding that smoking causes cancer.

ABC News: A recent study in Denver found that children who live in homes with higher magnetic fields are twice as likely to develop cancer as those who do not. Dr. David Savitz did the research.

Dr. David Savitz: We looked at the parents' smoking habits and medication use and the family income and we adjusted for a number of those factors and still it didn't explain away the association we saw.

ABC News: Scientists are now trying to pin down exactly what magnetic fields do to the human body. In San Antonio, Dr. Jerry Phillips subjects human leukemia cells to magnetic fields. He says it makes these cancer cells grow faster.

Dr. Jerry Phillips: In our studies we've seen increases in growth anywhere from 2 to 24 fold.

ABC News: So far there is no proven effect on normal cells. But all of this research has the electric power industry scrambling for answers.

Dr. Leonard Sagan: I think there is sufficient reason to conduct research and we're doing so.

ABC News: So is the federal government. Uncle Sam is paying for research at this lab in Kansas City where human volunteers are exposed to the same kind of magnetic fields you find right under power lines. The results show magnetic fields cause the heart to slow down and reduce mental concentration. But the experts disagree over whether enough is known to take action.

Dr. Leonard Sagan: Based on the evidence that exists there is no cause for concern or panic among members of the public.

Dr. David Carpenter: We cannot afford to sit on our duff for another five or ten years waiting for additional research projects to be done without taking some action on this issue.

by-case basis.

The DER's Buck Oven, who is in charge of writing the EMF rules, told *Microwave News* that the decision on whether to issue the rules is now up to the DER's Rule Review Committee, which is made up of the department's senior management. The committee will take up the issue at a meeting in mid-December.

Oven added that the legislature is still on record as desiring EMF standards and that local utilities do want rules adopted.

For a copy of the panel's report, contact: Buck Oven, DER, 2600 Blair Stone Rd., Tallahassee, FL 32301, (904) 487-2522.

EPRI News

The Electric Power Research Institute (EPRI) has produced four videotapes on power line electromagnetic fields (EMFs) and the institute's radiation program: (1) *Electric & Magnetic Fields and Human Health*, 15 minutes, narrated by Dr. Leonard Sagan; (2) *Electric & Magnetic Field Epidemiologic Studies*, 15 minutes, narrated by Robert Black; (3) *Measuring Electric & Magnetic Fields*, 7 minutes, and (4) *Using the EMDEX*, 9 minutes, both narrated by Dr. Stanley Sussman. (EMDEX stands for electric and magnetic field digital exposure—it is a portable dosimetry system.) Copies of the tapes are \$50.00 each; tapes 3 and 4 are on the same reel. Order from: Susan Rapone, EPRI, PO Box 10412, Palo Alto, CA 94303.

The cover story in the October/November issue of the *EPRI Journal* is "EMF and Human Health." The same issue also features an editorial by George Hildy, EPRI vice president in the environment division, titled "Field Effects—A Call for Research."

Sagan, who is the manager of EPRI's radiation studies program, is also the author of a new book: *The Health of Nations: True Causes of Sickness and Well-Being*, New York, NY: Basic Books, 233 pp., \$19.95.

Utility Survey: ROWs Are No. 1

In a recent survey, EPRI member utilities predicted that the siting of transmission line right-of-ways (ROWs) would be their number one environmental issue after 1995. For 1986 through 1995, the utilities ranked ROWs fifth after PCBs, acid rain, hazardous waste disposal and leaking underground storage tanks. When asked to rate environmental R&D concerns, the utilities ranked biological effects of electric and magnetic fields second only to acid rain. These results are cited in the *Ninth EPRI Member Utility Survey Results* (EPRI P-5160-SR), July 1987.

Advisory Subcommittees

EPRI has set up three subcommittees for advice on its radiation studies program. Listed below are the members of

the subcommittees, all of whom serve on the overall radiation studies program advisory committee under the chairmanship of Dr. Gilbert Omenn, the dean of the University of Washington School of Public Health in Seattle.

Basic Sciences Radiation Studies Program: Dr. Martin Blank, Columbia University, New York, NY; Dr. Kenneth Foster, University of Pennsylvania, Philadelphia; Dr. Marvin Goldman (co-chairman), Laboratory for Energy-Related Health Research, University of California, Davis; Dr. Arthur W. Guy, Bioelectromagnetics Research Lab, School of Medicine, University of Washington, Seattle; Dr. Alice Martin, Department of Obstetrics and Gynecology, Northwestern University Medical School, Chicago, IL; John McFeters (utility liaison), Division of Occupational Health and Safety, Tennessee Valley Authority, Muscle Shoals, AL; Dr. Thomas Tenforde (co-chairman), Lawrence Berkeley Laboratory, Berkeley, CA.

Epidemiologic Studies: Dr. A.A. Afifi, School of Public Health, University of California, Los Angeles; Dr. Patricia Buffler (chairwoman), School of Public Health, University of Texas, Houston; Dr. Philip Cole, School of Public Health, University of Alabama, Birmingham; Dr. Robert Hardy, School of Public Health, University of Texas, Houston; Betty Jensen (utility liaison), Public Service Electric and Gas, Newark, NJ; Dr. Carl M. Shy, School of Public Health, University of North Carolina, Chapel Hill.

Exposure Assessment: Dr. Dan Bracken (chairman), T. Dan Bracken, Inc., Portland, OR; Louis Hosek (utility liaison), Public Service of Oklahoma, Tulsa; Dr. William Kaune, National Bureau of Standards, Boulder, CO; Dr. Jim Quackenboss, Division of Respiratory Science, University of Arizona, Tucson; Dr. Howard Wachtel, Department of Electrical and Computer Engineering, University of Colorado, Boulder; John Wilson, Consolidated Edison Co., New York, NY.

HIGHLIGHTS

EMI Blamed for U.S. Army Helicopter Crashes

Electromagnetic interference (EMI) was responsible for the crashes of five Black Hawk helicopters—and the deaths of 22 servicemen—since 1982, according to a November 9 report by the Knight-Ridder Newspapers.

U.S. Army officials have denied the charge, as have spokesmen for Sikorsky Aircraft, the manufacturer of the \$6 million UH-60 Black Hawk.

The Black Hawk's stabilator, a movable rear wing designed to lift the aircraft's heavy tail automatically, is controlled electronically, rather than mechanically. Some Army accident investigators believe that the logic module which controls the stabilator is vulnerable to EMI from microwave antennas, radar equipment and radio transmitters.

Despite official denials of an in-flight EMI threat, the Army is now shielding the Black Hawks, according to the November 23 *Aviation Week*. The magazine reported that the Army acknowledges that the Black Hawk is susceptible to EMI—but only when it is on the ground.

According to a three-month investigation by Knight-

Assorted Notes

- The Edison Electric Institute (EEI), based in Washington, DC, is reactivating its electromagnetic fields (EMF) task force. Although formed in 1983, the task force was not very active until last summer, when the Savitz study was released by the New York State Power Lines Project. According to Richard Loughery, manager of EEI's environmental program, the institute is now tracking power line developments very closely and is getting information out to its members—investor-owned utilities. Loughery noted that the institute will not be duplicating the work of the Electric Power Research Institute (EPRI): EEI will be keeping companies up-to-date on new research, media coverage and regulatory and legislative developments.

- Citing the risk of miscarriages, the December issue of *Parents* magazine advises pregnant women to avoid using electric blankets. The short item (p.17) notes that, "Even off, electric blankets may threaten pregnancy," and that mothers-to-be should use down comforters or layers of woolly blankets. *Parents* magazine has a press run of more than two million copies.

- Prompted by the release of both the Savitz study and the New York State Power Lines Project report, the lead editorial in the September issue of *IEEE Spectrum* is on "Electromagnetic Hazards." It endorses continued research and observes that, "Undoubtedly the general press will follow the [New York] study panel's findings with tenacity and some enthusiasm, and, one hopes, with a minimum of 'yellow journalism'."

Ridder's Mark Thompson:

- In all five Black Hawk crashes, the aircraft were flying at altitudes below 1,000 feet when they suddenly dove into the ground. The Army blamed the first three crashes on mechanical and human error. The last two incidents are still officially unsolved.

- Army investigators have strongly suspected EMI from the outset. After a Black Hawk crashed near a CB transmitter in March 1986, the Army grounded the helicopters while the cause was sought. Investigators implicated three radiation sources—two microwave antennas and a CB transmitter. They also warned that 40 of the Black Hawk's 42 electronic systems are vulnerable to EMI and that there is a 50 percent chance of future accidents. In fact, four members of the accident board concluded that EMI was the possible initiating cause of the crashes. Jerry McVey, a former Army major who led the investigation, told Thompson, "I was shocked at the lack of shielding."

- Seven weeks after the March crash, the Army allowed the

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helicopters to resume operation and officially dismissed the possibility of EMI as the cause of the crash. It also deleted all mention of EMI from the accident report released under the Freedom of Information Act.

- An April 1987 incident, in which a Black Hawk suddenly dove 2,500 feet after flying near "a large electronic tower" in West Germany before the pilots regained control, prompted the Army to run extensive EMI tests at the Naval Air Test Center at Patuxent River, MD. The Army concluded that the Black Hawk is "susceptible but not vulnerable" to EMI.
- The U.S. Navy, which uses similar helicopters called Sea Hawks, banned its first 14 helicopters from flying near radio towers and subsequently shielded them to a much greater degree than the Army's Black Hawks.
- The Navy tested its Sea Hawks with multi-source radiofrequencies (RF) while the Army used only a single-source. The Army said that the Navy's methods were too expensive.

The Army is adding a back-up switch to protect the Black Hawk's hydraulic system, prohibiting any electrical devices from use on board, restricting the speed limit for flights at altitudes below 3,000 feet and warning pilots not to fly near RF emitters, according to *Aviation Week* (November 16).

Record OSHA Fine Cites Lax Radar Testing

On November 4, the Occupational Safety and Health Administration (OSHA) proposed a fine of \$4.2 million against the Bath Iron Works (BIW) in Maine – the largest fine against a single employer in the agency's history. Among the hundreds of violations cited by OSHA were eight instances of workers being exposed to radar radiation; these citations carry a total fine of \$64,000.

BIW has contested the citations. It will take months to settle the disagreement.

In March 1986, 23 workers claimed that they were overexposed to radar radiation from a U.S. Navy frigate while working in the company's Portland shipyard. Although it was raining on the morning in question, the men reported facial burns, red arms and suntans. BIW denied that the workers had been exposed, and OSHA was unable to show that the radar had been turned on and cited the company only for failing to post a radiation warning sign (see *MWN*, July/August 1986).

The November microwave citations were for "willful violations," which are defined as those in which "an employer either knew that a condition constituted a violation or was aware that a hazardous condition existed and made no reasonable effort to correct it." They were not based on radiation measurements, according to John Chavez, regional director for public affairs with the U.S. Department of Labor in Boston, MA. He explained that OSHA charged BIW with failing to observe its own procedures during radar testing.

Jim Mackie, a union official at BIW, told *Microwave News* that during a tour of the BIW yard, OSHA inspectors noticed

that the antennas on top of a ship were rotating, and, on checking further, found that the radars were turned on.

Months after the March 1986 incident, BIW officials issued a report which concluded that, "There is no clear-cut cause which we can find to explain the medical findings nor is there a clear-cut event we can seek to prevent from recurring." Though the report acknowledged that "fire control radars appeared to be the most likely source" of electromagnetic energy, the company maintained that none of the radars were radiating at the time of the incident.

The accident report is undated and unsigned and is not on BIW letterhead. Despite repeated requests from *Microwave News*, BIW representatives never released the report. A copy was made available by a union official, who said the company passed it out to BIW workers during a meeting.

One of the 23 workers, Dennis Brillant, who was operating a crane at the time of the incident, continues to suffer from psychological difficulties. He is still out of work – due at least in part to an apparently unrelated health problem. According to his attorney, John Sedgewick of Lewiston, ME, Brillant has been examined by a neurologist and a neuropsychologist, who both concluded that Brillant's condition appears to be related to radiation exposure.

FCC Proposes Major Changes to Part 15 RF Rules

On October 2, the Federal Communications Commission (FCC) issued its long-awaited proposal for a major overhaul of the Part 15 regulations governing the use of non-licensed radiofrequency (RF) devices. If approved, the rules will allow the FCC to replace its current case-by-case approach with uniform technical standards.

The revision covers both intentional (walkie-talkies, cordless telephones, security devices) and unintentional (VDTs, computers, receivers) radiators and proposes both conducted and radiated emission limits.

The FCC is proposing to allow intentional radiators to be "operated without restriction as to bandwidth, duty cycle, modulation technique or application" from 9 kHz to above 960 MHz, if they meet the designated limits (see Table below). Above 30 MHz, the radiated limits are the same for

Emission Limits for Intentional Radiators

| Frequency Band (MHz) | Field Strength ($\mu\text{V/m}$) | Measurement Distance (meters) |
|----------------------|------------------------------------|-------------------------------|
| 0.009-0.490 | 2400/f(kHz) | 300 |
| 0.490-1.705 | 24000/f(kHz) | 30 |
| 1.705-30 | 30 | 30 |
| 30-88* | 100 | 3 |
| 88-216* | 150 | 3 |
| 216-960* | 200 | 3 |
| Above 960* | 500 | 3 |

*Limits are identical for unintentional radiators.

intentional and unintentional emitters. Unintentional radiators would face no limits below 30 MHz.

The commission would allow fewer restrictions in some new bands in order "to foster entire new categories of Part 15 devices and to provide major benefits to both manufacturers and consumers." New products might include wireless stereo speakers, VCRs and computers. These new bands are primarily those already allocated to industrial, scientific and medical (ISM) equipment. Other bands (e.g., for safety services) would be prohibited.

For conducted emissions, the FCC is proposing a limit of 250 μ V in the 450 kHz-30 MHz band for both intentional and unintentional radiators. The commission has asked for comment on the need for conducted limits below 450 kHz and above 30 MHz.

In addition, the FCC plans to propose measurement procedures for all intentional and unintentional emitters. These will be based on the American National Standards Institute (ANSI) C63.2 and C63.4 standards as well as on current FCC procedures.

The proposal is long and complex and many experts preferred not to comment until they had analyzed it. Some argued that, while the revisions were an improvement over the present hodgepodge, the rules were still too complicated. The comment period has been extended until March 7, with reply comments due on May 9.

Robert Horvitz, executive secretary of the Association of North American Radio Clubs, told *Microwave News* that the proposal would encourage the proliferation of new devices, with the possible result that "local interference in urban areas will drown out the reception of many foreign stations."

For more information, contact: John Reed, Room 7122, Technical Standards Branch, FCC, Washington, DC 20554, (202) 653-6288.

RF Lighting: FCC Drops Radiated Limits Below 30 MHz

The Federal Communications Commission (FCC) has abandoned its 1986 proposal to set limits on radiated emissions below 30 MHz from RF lighting devices. In an October 9 decision, the commission concluded that existing regulations are adequate to protect communications services – even highly susceptible ones such as AM broadcasting and amateur radio – from electromagnetic interference (EMI) from RF lighting. As a result, RF lighting devices will continue to be regulated under the FCC's Part 18 rules for industrial, scientific and medical devices.

Last year, responding to pleas from the National Association of Broadcasters (NAB), the FCC proposed radiated emissions limits, though weaker ones than those requested by the NAB (see *MWN*, May/June 1986).

In a report and order released on November 2, the commission stated that it was canceling its proposal because most radiated emissions below 30 MHz stem from power cords and limits on conducted EMI should effectively deal with the problem, and because it did not know of any EMI incidents, other than those caused by defective devices.

Michael Rau, an NAB staff engineer, told *Microwave News* that the NAB has no immediate plans to petition the FCC to reconsider its decision. He said that there are some technical questions related to measuring radiation from RF lighting devices which must still be settled. When these questions are resolved, the NAB might then ask the FCC to take another look at the problem.

Meanwhile, the FCC said that it will continue to monitor the development of RF lighting. For more information, contact: Liliane Volcy in the FCC's Office of Engineering and Technology, (202) 653-7316.

In our last issue some of the division signs in the 1.2-3MHz and 3-30 MHz bands were inadvertently omitted. Below is the corrected chart.

Canadian General Population & Occupational RF/MW Exposure Limits

| Frequency | E _{occup} (V/m, rms) | E _{pop} (V/m, rms) | H _{occup} (A/m, rms) | H _{pop} (A/m, rms) |
|--------------|--|---|----------------------------------|--------------------------------|
| .01-1.2 MHz | 600 | 280 | 4.0 | 1.8 |
| 1.2-3 MHz | 600 | 280 | 4.8/[f] | 2.1/[f] |
| 3-30 MHz | 1800/[f] or 3120/[f ^{1.5}]* | 840/[f] or 1600/[f ^{1.5}]* | 4.8/[f] | 2.1/[f] |
| 30-100 MHz | 60 or 20* | 28 or 10* | 0.16 | 0.07 |
| 100-300 MHz† | 60 or 0.2[f]* | 28 or 0.1[f]* | 0.16 | 0.07 |
| 0.3-1.5 GHz | 3.45[f ^{0.5}] | 1.61[f ^{0.5}] | 0.0093[f ^{0.5}] | 0.004[f ^{0.5}] |
| 1.5-300 GHz‡ | 140 | 60 | 0.36 | 0.16 |

Pop = general population; Occup = occupational; f = frequency in MHz; E=electric field; H=magnetic field.

* The lower limits apply only when the exposed person is less than 0.1 m from electrical ground; in all other cases the higher limits apply.

† For 100-300 MHz, the power density is 1 mW/cm² for occupational exposure and 0.2 mW/cm² for general population exposure. For 1.5-300 GHz, the power density is 5 mW/cm² for occupational exposure and 1 mW/cm² for general population exposure.

be available in six to nine months.

In our last issue, we published the full text of the testimony of Drs. Robert Becker, Jerry Phillips and David Savitz. Reprinted below are the recommendations Dr. Ross Adey made at the hearing. These are adapted from the conclusions of a draft report prepared by a panel chaired by Adey for the Committee on Interagency Radiation Research and Policy Coordination (CIRRPC), which was set up by President Reagan's science advisor in 1984 (see *MWN*, November/December 1985). The panel's report has never been issued.

In other testimony:

- Dr. Leonard Sagan of the Electric Power Research Institute

(EPRI) said that the National Cancer Institute (NCI) would be an "appropriate sponsor" of a large epidemiological study of childhood cancer. Sagan also emphasized that EPRI places no constraints on the publication rights of those who are funded by the institute.

- Sheldon Meyers, the director of the Office of Radiation Programs at the Environmental Protection Agency (EPA), said that while more research is needed on the health effects of electromagnetic fields, EPA has no plans in that area.

- Donna Fitzpatrick, assistant secretary of the Department of Energy (DOE), said that the DOE is committed to continued funding of research on the health effects of power line fields.

FROM THE FIELD

Congressional Hearings on the Health Effects of Power Lines

Reprinted below are the "Recommendations" made by Dr. Ross Adey of the VA Hospital, Loma Linda, CA, in his testimony before the House subcommittee on water and power resources on October 6.

A. Steps Towards Implementation of Health Safety Standards

1. There is a growing and even urgent need for early establishment of national safety standards that would govern exposures to non-ionizing EM fields in the workplace, in the home and in the general environment.

2. These standards would be regarded as interim at the time of promulgation, since current epidemiological knowledge and experimental evidence remain incomplete in precisely defining mechanisms of EM field interaction with body tissues and in evaluating the exact role of these EM fields in human disease. Although incomplete, current knowledge may be considered adequate for establishment of interim standards.

3. Interim standards should cover exposures to environmental fields from ELF frequencies (below 300 Hz) to millimeter waves at 300 GHz. For radio and microwaves, an early requirement involves consideration of pulse- or amplitude-modulation of the carrier wave, since these low frequency characteristics of the field largely determine modes of tissue interactions at athermal field levels.

4. Beyond establishment of interim standards, a major new effort will be necessary in reviewing current research developments and incorporating new knowledge into more refined and more comprehensive standards.

5. There is need for an interagency coordinating group with cognizance over the whole spectrum of the national research and regulatory effort. In the past, the Electromagnetic Radiation Management Advisory Council (ERMAC) offered much-needed foci for research planning and dissemination of information. This need is now especially acute, in times of small budgets and restricted funding. Lack of communication between federal agencies and other funding bodies hampers research and enhances risks of duplication of effort.

B. Research Program Priorities and Logistics

1. There is now substantive experimental evidence for significant modulation of physiological functions in the mammalian body from exposure to environmental EM fields at levels below those producing significant tissue heating.

2. Much further research will be necessary to establish the physical nature of mechanisms of interaction, which involve non-equilibrium states and long-range interactions in biomolecular systems. The magnitude of the problem, its importance in the context of human health and disease, and the absence of an adequate national research

program at this time all emphasize the urgency of implementing such a program in the immediate future.

3. It will be of the highest importance to ensure appropriate long-term funding of this research, to be conducted on a team basis by appropriately skilled scientists. Failure to institute research programs on this basis will prevent formation of these teams, with inevitable consequences for the quality and timeliness of urgently needed research.

4. There will be a mandatory requirement for close interdisciplinary collaboration between physical and biological scientists if future research goals are to be achieved.

5. Specific research goals include studies of EM field effects on fetal development; responses of the immune system with emphasis on compromised functions that may lead to malignant disease; a search for physical and chemical mechanisms underlying these sensitivities, including the molecular biology of intercellular communication disrupted in cancer promotion; interactions between drugs and cancer-promoting chemicals at cell membranes; and EM field effects on responses of hormonal and neuroregulatory substances in brain tissue relating to biological rhythms and stress responses.

6. Special exposure facilities will be required to evaluate effects of long-term, intermittent exposures in a variety of animal models. These facilities are needed for both low-frequency and radio frequency studies. They should be established as national regional centers.

7. Epidemiological studies will elucidate correlates between EM field exposure and increased risks of disease and teratological problems in fetal development. Epidemiological studies will be most effective when conducted with insights into the mechanistic basis of EM field bioeffects, including responses to long-term intermittent exposures. Epidemiological yardsticks derived from studies of ionizing radiation in cancer offer little in the design and conduct of needed studies in non-ionizing radiation.

8. Implementation of a national research program should take account of administrative experience and mission orientation of those federal agencies with previous commitments to bioelectromagnetic research. Successful program management in this research field requires broad experience in interdisciplinary research between the physical and life sciences, and a keen awareness of current developments at the frontiers of electrical and electronic engineering applications. Those federal agencies already experienced in these sensitive areas of creative interdisciplinary research may merit consideration for continuing lead roles. Agencies with missions restricted to the health sciences and without these broader commitments or appropriate previous experience may constrain the timely and effective development of urgently needed new knowledge.

BIOLOGICAL EFFECTS

Magnetic Field Teratology...A research group from the Canadian Bureau of Radiation and Medical Devices in Ottawa and Bio-Research Labs in Senneville, Quebec, has failed to find major effects of sawtooth magnetic fields on developing rat embryos. The team exposed groups of female rats to 18 kHz fields seven hours a day for 15 days before pregnancy and for 22 days during pregnancy, at three intensities: 5.7, 23 and 66 μ T. Speaking at the power line health effects review in Kansas City, MO, on November 3, Dr. Maria Stuchly of the radiation bureau said that the team's working hypothesis was that the induced current (dB/dt) is the crucial variable. At the three exposure levels, the time-rates-of-change of the magnetic field were 0.48, 1.82 and 5.65 T/s, respectively. Stuchly said that when the results were analyzed on the basis of litters, there were no significant effects on the weight of the fetuses, the number of malformations or the number of fetuses per litter. In the group subjected to the highest exposure, there was, however, a statistically significant increase in minor skeletal anomalies – reduced ossification of ribs. Stuchly said that while the experiment was prompted by the Swedish and Spanish teratological studies on mice and chick embryos, which suggested pregnancy risks for VDT operators, she had not attempted a replication of those studies. She told *Microwave News* that by exposing the rats only seven hours a day – in contrast to the 24-hour exposures in the previous studies – she was trying to better simulate the “real life” exposure conditions of VDT workers.

RF Teratology...One of the most intriguing findings in recent years is the report by a team of Italian researchers, led by Dr. Santi Tofani at the Public Health Labs in Ivrea, showing RF teratological effects in rats at *extremely* low power levels – SAR = 1.1×10^{-4} W/Kg (see *MWN*, November/December 1986). Now Drs. Shin-Tsu Lu and Sol Michaelson of the University of Rochester, NY, have expressed their “surprise” at the lack of technical details in the paper. Writing in the November issue of *Health Physics*, they concede that the Tofani paper “may prove to be a landmark observation,” and then they outline some of the details they would like explained – e.g., the size of the plastic animal cages and the type of absorbing materials used in the exposure chamber. In a reply, after answering these and other specific questions, Tofani and coworkers conclude, “We want to point out that for the vast majority of people, the exposure to RF and MW fields is a long-term, low-level one to various waveforms that spread over a vast frequency of the spectrum and therefore the determinations of potential biological effects due to exposure to RF and MW have to be seen within this frame. The SAR parameter is not adequate for describing all these exposure conditions. Therefore, the thermal hypothesis may be a misleading prejudice.”

COMPATIBILITY & INTERFERENCE

Power Lines and TVI...The Canadian Electrical Association (CEA) has issued a new report – its third – on TV interference (TVI). According to a study by Ontario Hydro, the greatest source of interference from distribution lines is gap discharges from loose pole hardware, either capacitively or conductively coupled to the line voltage. The CEA also tested a new TVI measurement method based on noise amplitude distribution, originally proposed by EPRI in an earlier CEA project, but does not recommend it because of the required sophisticated instrumentation. Instead, the report favors the more commonly used CISPR quasi-peak and rms parameters. A copy of the report, *TV Interference Study on Distribution Test Line*, Project 205 D 406, is available for \$35.00 (CEA members), \$50.00 (non-members), prepaid from CEA, R&D Division, Suite 500, One Westmount Square, Montreal, Quebec H3Z 2P9, Canada, (514) 937-6181. For more information, contact J.A. Roiz, at the same phone number. See also *MWN*, September/October 1986.

Astronomers vs. Broadcasters...The frequencies once reserved for British radio astronomers have been taken over by broadcasters, according to the October 1 *New Scientist*. Under an international agreement, astronomers are allowed to use 26 frequencies between 37.75 MHz and 49 GHz, but have first choice on only 14 of those. The other 12 have, up until now, been left clear by broadcasters as a “favor.” But now that the British government wants to start a fifth television network, broadcasters will need extra channel space. Writer Barry Fox notes that the astronomers have no legal recourse. See also Fox's piece, “Corrupt Power Corrupts Computer Data,” in the magazine's October 29 issue.

MEETINGS

A Two-Edged Sword...The Engineering Foundation is sponsoring a week-long conference, *Electromagnetic Radiation: A Two-Edged Sword*, scheduled for March 27-April 1 in Santa Barbara, CA. According to Ron Peterson of AT&T Bell Labs, who is co-chairing the meeting with Dr. Paul Tyler, a private consultant formerly with the U.S. Navy, the meeting was prompted by recent research on power line fields – notably the Savitz study – as well as by work on calcium efflux and other frequency-specific effects. The press release announcing the meeting notes that, “There is a concern that a schism may be developing between some users of electromagnetic energy and a part of the scientific community. This conference has been organized to help bridge that gap....” A similar meeting was held in October 1984 (see *MWN*, April 1984). Attendance, which costs \$575-\$725, depending on whether one is sharing a room, is by invitation or application only. Peterson said that the meeting will be held only if there is enough interest; he estimated that the minimum attendance would be

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approximately 100 people. For more information, contact: Harold Comerer, Engineering Foundation, 345 East 47th St., New York, NY 10017, (212) 705-7835.

BRAGS Proceedings...More than 150 people from 13 countries attended this year's meeting of the Bioelectrical Repair and Growth Society (BRAGS), held in Toronto, Canada. Among the highlights was a paper by Dr. G. Borsalino and coworkers on one of the first double-blind clinical studies, which indicates the efficacy of 75 Hz PEMFs in the treatment of osteotomies – the stimulation of bone growth following an operation. The conference *Transactions* with the 92 abstracts of the presentations are available for \$45.00 from BRAGS, PO Box 64, Dresher, PA 19025.

Capri in the Spring...Do you want to take a short course on *Worldwide Non-Ionizing Radiation Safety Standards: Their Rationale and Problems* taught by lecturers from Italy, Sweden and the U.S.? Do you want to go to the Italian island of Capri in the spring? Next May 2-6, you can do both. For more information, contact: Dr. Om Gandhi, Department of Electrical Engineering, University of Utah, Salt Lake City, UT 84112, (801) 581-7743.

EMC Society Papers...Hugh Denny of the Georgia Tech Research Institute, the chairman of the 1987 *IEEE International Symposium on Electromagnetic Compatibility*, held in Atlanta, GA, August 25-27, reports that there were more than 1,100 attendees and exhibitors at this year's meeting. He said that there was a great deal of interest in both the measurement of radiation emissions from computing devices, and – to the surprise of many – the workshop on the shielding of cable and connectors. A copy of the symposium record containing the 88 papers presented is available from the IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854, (201) 981-0060; order No. 87CH2487-7, \$31.00 for IEEE members and \$62.00 for non-members.

EM Bioeffects in Israel...A group of German and Israeli organizations is sponsoring an *International Symposium on Interaction of Electromagnetic Fields with Biological Systems*, which will be held March 21-24 in Tiberias on the Sea of Galilee, Israel. Many of the speakers listed in the preliminary agenda are new to the conference circuit. The official languages of the meeting will be English and German. For more information, contact: ORTRA, Ltd., 2 Kaufman St., Tel Aviv 61500, Israel, (3) 664825.

MILITARY SYSTEMS

GWEN's Impact...After releasing a draft environmental impact statement (EIS) in April on its Ground Wave Emergency Network (GWEN), the U.S. Air Force (USAF) completed a final EIS this September. It includes public hearing reports, comments on the draft and the USAF's responses.

The GWEN communication system, operating at 150-175 kHz and designed to withstand the EMP of a nuclear attack, will consist of 127 relay nodes at 150-200 mile intervals across the continental U.S. The USAF has adopted a 50 V/m standard for public exposures to GWEN radiation (see *MWN*, January/February and November/December 1986). On September 2, the Conservation Law Foundation (CLF) in Boston, MA, sued the USAF for failing to complete a separate EIS for each tower site and for not acknowledging the possibility that GWEN towers could be the targets of nuclear attacks. The U.S. District Court for Massachusetts denied the CLF's motion for a preliminary injunction against the construction of two GWEN towers in Maine and ruled that the National Environmental Policy Act (NEPA) does not require the USAF to study the effects of nuclear war. However, the court did agree that the USAF should have prepared an EIS for each site. To request a copy of the GWEN Final EIS, contact: Robert Le Blanc, ESD/DE3, Hanscom AFB, MA 01731, (617) 271-6354.

OCCUPATIONAL HEALTH

Rating MW Protective Suits...Fabrics which can attenuate microwave radiation can also be flammable, thereby forcing a tradeoff between radiation overexposures and fire hazards. Drs. Bill Guy and C.-K. Chou tested five microwave-protection suits and only the one made of a new "improved" fiber provided a combination of shielding and fire resistance. In the first of two papers, both appearing in the November issue of the *IEEE Transactions on Microwave Theory and Techniques*, they describe their test results with four of the suits – those from Wave Guard (used by AT&T), Milliken, Invascreen and the U.S. Navy. The Navy suit gave the best protection (34-49 dB), but was very flammable. In contrast, the Milliken suit was the most fire retardant, but its shielding performance was the poorest. In the second paper, Guy, who is at the University of Washington in Seattle, and Chou, who used to collaborate with Guy and is now at the City of Hope National Medical Center in Duarte, CA, report that Milliken and Body Guard, a division of Lion Uniform, have jointly developed a material that can attenuate 2450 MHz radiation by at least 25 dB, and 915 MHz radiation by 20 dB. The fabric can also be machine-washed many times with only a small loss of radiation shielding. Guy and Chou conclude that the Milliken-Body Guard suit "can provide good protection for microwave frequencies above 650 MHz," but that "more work is needed...to develop a suit suitable for protecting workers from high radiation levels at broadcasting (VHF) and shortwave (HF) frequencies" (see also *MWN*, December 1981).

OVENS

Better Bacon...Cooking bacon in a microwave oven prevents carcinogenic chemicals from forming and has no effect on

taste, say scientists at the National Center for Toxicological Research in Jefferson, AR. According to an item in the *New Scientist* (September 24) grilling or frying bacon produces high levels of nitrosamines, potent cancer-causing agents, while cooking bacon with microwaves for 45 seconds does not.

The Hot Seller...More microwave ovens were shipped in October than any major appliance in any month in history, according to the Association of Home Appliance Manufacturers. The 1.3 million microwave ovens sent out exceeded all monthly shipments for dishwashers, refrigerators, washers or dryers. So far this year, 10.1 million microwave ovens have been shipped – a slight increase over last year.

PEOPLE

With the acquisition of a controlling interest in Electro-Biology Inc. (EBI) by Biomet Inc., all members of EBI's board of directors have been replaced – except for Thomas Duerden, EBI's CEO. The board had advised stockholders against accepting Biomet's \$6.25-a-share offer....There have also been changes at Clini-Therm Corp., a leading manufacturer of hyperthermia equipment: William Flaherty has resigned as president and Franklin Jarman, a former president, has taken over on a temporary basis....Terry Strong, the head of the Office of Radiation Protection in Washington state, is the new chairman of the Conference of Radiation Control Program Directors....Dr. Genevieve Roessler of the University of Florida in Gainesville is stepping down as the editor-in-chief of *Health Physics* next September. A search for a replacement is underway.

STANDARDS

CISPR Publications...The International Special Committee on Radio Interference (CISPR) will soon publish a report on RFI limits for industrial, scientific and medical (ISM) equipment, which will include a discussion of how CISPR and the International Radio Consultative Committee (CCIR) should collaborate on their research efforts. The cost of the report, designated CISPR Publication 23, was not available at press time. In addition, CISPR has published an amendment to *Limits and Methods of Measurement of Radio Interference Characteristics of Household Electrical Appliances, Portable Tools and Similar Electrical Apparatus*, CISPR 14-1985, Amendment No. 1 to 1987 (\$6.00). CISPR has also published – as six-month draft rules – *Limits and Methods of Measurement of Radio Interference Characteristics of Sound and Television Receivers*, CISPR/E (Central Office) 25, Amendment of 4.1 of CISPR 13 (\$7.00) and five parts to a forthcoming document, *Sound and Television Broadcast Receivers and Associated Equipment Limits and Methods of Measurement of the Immunity Characteristics in the Frequency Range 0.15 MHz to 1 GHz*, CISPR/E (Central Office) 19-23 (the total cost

for all five parts is \$162.00). All publications are available, prepaid, from the American National Standards Institute, International Sales Department, 1430 Broadway, New York, NY 10018, (212) 642-4900. The ISM document will be available in a short time.

Swedish Radiation Devices...The Swedish Ministry of Environment and Energy has proposed new legislation for products that emit ionizing and non-ionizing radiation. If adopted, the requirements will take effect on July 1, 1988. At present, the text is only available in Swedish, but a translation is being prepared. The Swedish text is free, while the cost of the English version will be divided among those ordering copies. For more information, contact: JoAnne Overman, Office of Standards Code and Information, NBS, Administration Building Room A629, Gaithersburg, MD 20899, (301) 975-4037. Ask for regulation TBT/Notif.87.154.

ETC...

NIER in Health Physics...The December issue of *Health Physics* features a special section on non-ionizing radiation, with papers by Drs. Bill Guy, Tom Tenforde, Bill Kaune and Joe Elder. In addition, Dr. Maria Stuchly presents the proposed revised Canadian RF/MW exposure standard (see *MWN*, September/October 1987).

Reading List...The December issue of *The Sciences*, published by the New York Academy of Sciences, features an article on the blood-brain barrier by UCLA Professor William Partridge – “The Gatekeeper: How Molecules Are Screened for Admission to the Brain.”...Dr. Marvin Goldman of the Laboratory for Energy-Related Health Research at the University of California at Davis, who is the co-chairman of one of EPRI's radiation studies advisory committees (see p.7), argues in the October 30 *Science* that the radiation impact of the Chernobyl nuclear accident will be quite small....Corby Kummer describes the pleasures of cooking with a microwave oven and the status of the oven safety debate in “Fast Fish” in the December issue of *The Atlantic*....Confused about recent developments on superconductivity? Check out Philip Campbell's “primer” in the November 5 issue of *Nature*....Sudden infant death syndrome (SIDS) may be connected to a baby's melatonin level. See the short item in the September 10 issue of the *New Scientist*....And in the magazine's November 5 edition, there is an item on “Magnetic Anomaly Upsets Migrating Birds.”...N.B. Eastwood offers “Some Observations on Dowsing and the Human Magnetic Sense” in the September 19 *Lancet*.

Louis Slesin, editor of *Microwave News*, reviews the ELF bioeffects debate and the cutbacks in research funding in “Power Lines and Cancer: The Evidence Grows,” which appears in the October issue of *Technology Review*, an MIT publication.

Florida Supreme Court Orders New Trial in ROW Cases

A unanimous decision by the Florida Supreme Court has overturned two large awards against Florida Power & Light Co. (FP&L) for property value losses of land adjacent to lots condemned for the right-of-way (ROW) of a 500 kV power line (see *MWN*, September/October 1986). The seven-judge panel ruled that expert testimony on power line health effects was "inflammatory" and "prejudicial," and should not have been allowed in an eminent domain case.

The court did *not* contest the allegation that power lines reduce the value of property along the ROW or that "public fear" has an impact on land values. In fact, the court found that a jury could, if it so believed, judge the reasonableness of an award on the public belief that power lines "attract alien beings in flying saucers." The judges concluded that, "Whether this fear is objectively reasonable is irrelevant to the issue of full compensation in an eminent domain proceeding." But the court *did* hold that "scientific testimony altered the focus of the trial and confused the issue to be determined."

Carlos Alvarez of the Tallahassee law firm of Hopping, Boyd, Green & Sams, who represented FP&L, told *Microwave News* that the court was essentially saying that, "You cannot turn an eminent domain case into a personal injury case. That would confuse the issue."

The two cases will now go back to a lower court to be heard by a new jury. In accordance with the Supreme Court ruling, expert witnesses will not be allowed to testify.

Florida Power & Light Co. vs. S.B. Jennings aka Bryan Jennings, Jr., et al. and Florida Power & Light Co. vs. Virginia Roberts et al., Supreme Court of Florida, Nos. 68,593 & 69,069; September 3, 1987.

Power Line Suit (continued from p.1)

telephone interview. "It legitimizes the EMF hazard issue. It will have a significant impact on every utility in the country."

Harris Leven, HL&P's attorney, takes a different view; his reading of the opinion indicates that the court has not ruled on the scientific legitimacy of the issue. "I think the jury is still out on the ultimate question of the health effects of EMFs. The issue is still inconclusive," he told *Microwave News*. He argues that a different jury could have arrived at a different conclusion based on the same scientific facts.

Power Line Has Been Moved

In 1986, the Texas Supreme Court refused to allow HL&P to use the power line pending the outcome of this appeal (see *MWN*, November/December 1986). HL&P subsequently rerouted the line around school property at a cost of \$8.6 million, according to a spokesman for the utility.

Montague notes that in denying HL&P the use of the line, the Supreme Court reversed — by a unanimous 9-0 vote — a previous ruling by Judge Pressler. "It is probable they will overrule him again," Montague said. He added that HL&P has already made overtures to him to settle the case out of court. "Why would they rush to us wanting to settle if they had won?" he asked.

Judge Pressler awarded the school district \$104,275 in damages, though HL&P had originally paid the school district \$78,604 for the power line right-of-way. Leven and Montague also disagree on the significance of that award. Leven calls it something akin to rent for the time the line was on school property. Montague believes that the judge's award constitutes damages for trespass because the line was removed.

At the jury trial, HL&P called Dr. Edwin Carstensen of the University of Rochester, NY, as an expert witness on the health effects of power line EMFs. Montague called Dr. Harris Busch of the Baylor College of Medicine in Houston, TX; Dr. Jerry Phillips of the Cancer Therapy and Research Center in San Antonio, TX; and Dr. Nancy Wertheimer of the University of Colorado in Boulder.

CONFERENCES

1988 Conference Calendar

January 5-8: National Radio Science Meeting, University of Colorado, Boulder, CO. Contact: Prof. S.W. Maley, Dept. of Electrical Engineering, University of Colorado, Boulder, CO 80309.

January 27-31: International Symposium on Work in a Hot Environment and Heat-Related Disorders, Khartoum, Sudan. Contact: Dr. Moneim Attia, Chief, Occupational Physiologist, Ministry of Health, PO Box 303, Khartoum, Sudan.

January 31-February 5: 1988 Winter Meeting of the IEEE Power Engineering Society, Penta Hotel, New York, NY. Contact: IEEE Society Special Services, 345 East 47th Street, New York, NY 10017, (212) 705-7895.

March 10-11: 14th Northeast Bioengineering Conference, University of New Hampshire, Durham, NH. Contact: Dr. John LaCourse, Dept. of Electrical and Computer Engineering, University of New Hampshire, Durham, NH 03824.

March 21-24: International Symposium on Interaction of Electromagnetic Fields with Biological Systems, Plaza Hotel, Tiberias on the Sea of Galilee, Israel. Contact: ORTRA Ltd., 2 Kaufman St., 61500 Tel Aviv, Israel, (3) 664825.

March 27-April 1: Electromagnetic Radiation: A Two-Edged Sword, Sheraton Hotel & Spa, Santa Barbara, CA. Contact: Engineering Foundation, 345 East 47th St., New York, NY 10017, (212) 705-7835.

March 30-31: 24th Annual Meeting of the National Council on Radiation Protection and Measurements (NCRP), Washington, DC. Contact: NCRP, 7910 Woodmont Ave., Suite 1016, Bethesda, MD 20814, (301) 657-2652.

April 8-12: 66th Annual Convention and International Exposition of the National Association of Broadcasters (NAB) and 42nd Annual Broadcast Engineering Conference, Las Vegas, NV. Contact: NAB, 1771 N St., NW, Washington, DC 20036, (202) 429-5300.

April 10-17: 7th International Congress of the International Radiation Protection Association (IRPA), Centerpoint Convention Center and Hilton Hotel, Sydney, Australia. Contact: IRPA 7 Secretariat, GPO Box 2609, Sydney, NSW 2001, Australia, (02) 241 1478.

April 11-13: 4th International Conference on HF Systems and Techniques, London, U.K. Contact: Conference Services, Institution of Electrical Engineers, Savoy Place, London WC2R 0BL, U.K., (1) 240-1871, ext. 222.

April 18-21: 1988 International Symposium on Radio Propagation (ISRP '88), Beijing, China. Contact: Prof. Sha Zong (Z. Sha), China Research Institute of Radiowave Propagation, PO Box 138/88, Xinxiang, Henan, People's Republic of China.

April 19-21: 1988 International Conference on Lightning and Static Electricity, Oklahoma City, OK. Contact: Michael Glynn, FAA Technical Support Center, ACT-430, Atlantic City Airport, NJ 08405, (609) 484-4138.

April 19-22: Instrumentation/Measurement Technology Conference (IMTC/88), San Diego, CA. Contact: Robert Meyers, 1700 Westwood Blvd., Suite 101, Los Angeles, CA 90024, (213) 475-4571.

April 20-21: IEEE 1988 National Radar Conference, Ann Arbor, MI. Contact: University of Michigan Extension Service, Department of Conferences and Institutes, 200 Hill St., Ann Arbor, MI 48104, (313) 764-5304.

April 20-22: 4th Annual Meeting of the Electromagnetic Energy Policy Alliance (EEPA), Radisson Mark Plaza Hotel, Alexandria, VA. Contact: EEPA, 1255 23rd St., NW, Washington, DC 20037, (202) 452-1070.

April 24-30: Magnetic Resonance Imaging 1988: 5th Annual National Symposium, Buena Vista Palace, Disney World/EPCOT Center, FL. Contact: Florida Radiological Society, PO Box 17241, Tampa, FL 33682, (813) 873-2090, (800) 338-5901.

April 25-26: 25th Annual Rocky Mountain Bioengineering Symposium, Air Force Academy, Colorado Springs, CO. Contact: Dr. Harry Valenta, Jr., Telectronics, 7400 S. Tucson Way, Englewood, CO 80112, (303) 790-8000.

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

May 14-18: 23rd Annual Meeting & Exposition of the Association for the Advancement of Medical Instrumentation (AAMI), Sheraton Washington Hotel, Washington, DC. Contact: Debbie Tridle, AAMI, 1901 North Fort Myer Dr., Suite 602, Arlington, VA 22209, (703) 525-4890.

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

May 16-20: 1988 Nuclear EMP Meeting, SRI International, Menlo Park, CA. Contact: K.F. Casey, JAYCOR, 39650 Liberty St., Suite 320, Fremont, CA 94538.

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

June 1-3: 42nd Annual Frequency Control Symposium, Stouffer Harborplace Hotel, Baltimore, MD. Contact: T.R. Meeker, 2956 Lindberg Avenue, Allentown, PA 18103.

June 6-9: 1st Congress of the International Society of Ocular Toxicology, University of Toronto, Ontario, Canada. Contact: Continuing Education, Faculty of Medicine, University of Toronto, Toronto, Ontario M5S 1A8, Canada, (416) 978-2718.

June 6-10: 1988 IEEE AP-S International Symposium & URSI Radio Science Meeting, Syracuse University, Syracuse, NY. Contact: A.T. Adams, 111 Link Hall, Syracuse University, Syracuse, NY 13244, (315) 423-4397/4393.

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

June 27-30: 5th International Conference on Dielectric Materials, Measurements and Applications, University of Kent at Canterbury, U.K. Contact: Conference Services, Institution of Electrical Engineers, Savoy Place, London WC2R 0BL, U.K., (1) 240-1871, ext. 222.

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

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

July 12-15: 4th Joint Magnetism and Magnetic Materials - InterMag Conference, Hotel Vancouver, Vancouver, British Columbia, 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 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) 257-5661.

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.

August 29-September 3: 5th International Symposium on Hyperthermic Oncology (ISHO), Kyoto, Japan. Contact: Secretariat, ISHO, Health Research Foundation, Matsuo Bldg. 4F, Kawaramachi Marutamachi Sagaru, Kamigyo-ku, Kyoto 602, Japan.

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

September 28-October 1: 3rd International Conference on Harmonics in Power Systems, Nashville, TN. Contact: Dr. G.T. Heydt, School of Electrical Engineering, Purdue University, West Lafayette, IN 47907, (317) 494-3520.

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.

November 3-7: 10th Annual Conference of the IEEE Engineering in Medicine & Biology Society, Meridien Hotel, New Orleans, LA. Contact: Dr. Cedric Walker, Dept. of Biomedical Engineering, Tulane University, New Orleans, LA 70118, (504) 865-5866.

November 8-10: Journées Internationales de Nice sur les Antennes (JINA'88), Nice, France. Contact: J.L. Guiraud, CNET/PAB - La Turbie, 06320 Cap D'Ail, France, 93.41.15.30.

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