

# MICRO WAVE NEWS

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## Henhouse Project: Weak PMFs Cause Chick Abnormalities

The combined results of studies from six labs in four countries indicate that extremely weak pulsed magnetic fields (PMFs) can have a detrimental effect on the development of chick embryos. In a paper to be presented at the *Annual Meeting of the Bioelectromagnetics Society (BEMS)* in June, the international team will report that five of the labs found increases in the number of abnormalities among exposed embryos. Although the increase was statistically significant in only two of the labs, the pooled data from all six labs were, as a whole, highly significant.

The "Henhouse" project was prompted by a number of reports – beginning in 1982 – from Dr. Jocelyne Leal at the Ramón y Cajal Hospital in Madrid, Spain, which showed that very weak PMFs could have profound and consistent effects on the developing chick embryo (see *MWN*, March and November 1983 and December 1984). A number of later attempts to repeat the findings met with mixed success (see *MWN*, June 1984 and May/June 1986), prompting the U.S. Office of Naval Research (ONR) to support an international effort to either confirm or refute the Leal findings (see *MWN*, January/February 1986).

The new results (see the abstract of the BEMS paper on p.14) should help convince skeptics that magnetic fields can be biologically active at very low levels. As Jack Monahan of the Food and Drug Administration in Rockville, MD – one of the six Henhouse researchers – explained in a

(continued on p.14)

## Revision of ANSI RF/MW Safety Standard Stalled

Work on the revision of the American National Standards Institute (ANSI) standard for human exposures to radiofrequency and microwave (RF/MW) radiation is at a standstill. Resignations, worries over liability, lack of funds and an extraordinarily cumbersome review procedure have halted progress towards revising the 1982 standard, which – in the absence of federal rules – has become the most influential RF/MW health guide in the U.S.

Dr. Kristian Storm, the chairman of the ANSI-accredited subcommittee IV of Committee C95 on Non-Ionizing Radiation Hazards, resigned in December. Soon afterward, Professor Saul Rosenthal announced that he would step down as the chairman of the C95 committee. In addition, the U.S. Navy, which has served as co-secretariat of the committee with the Institute of Electrical and Electronics Engineers (IEEE), wants to give up its long-standing support of C95.

(continued on p.15)

## « Power Line Talk »

Dr. David Carpenter was at the center of a roundtable discussion on EMF risks with utility staffers at the February meeting of the IEEE Power Engineering Society in New York City. He fielded questions such as, "We are getting a lot of pressure to fix something, but do we know what to fix?" and "If the EMF risk is so much smaller than that of cancer from smoking, how much attention should we place on it?" and "How does the risk from power lines compare to those from wood stoves or from radon?" On the one hand, he replied, "This is a relatively minor risk," but on the other hand, he added, "Because no one has paid much attention to it, we don't know how difficult it is to correct. Perhaps we could save many children's lives at little cost." He estimated that, if the EMF-cancer link is confirmed, at least 1,000 cases of childhood cancer could be attributed to magnetic fields. In a commentary appearing in *Health & Environment Digest*, a new newsletter published in Minneapolis, MN, Carpenter derives this estimate and elaborates on the often-quoted figures from the New York State Power Lines Project (PLP), that magnetic fields from power lines could be responsible for 10-15% of childhood cancers: "The estimate of 10-15%, however, is restricted to cancers due to the distribution system at the residence, and does not consider exposure from appliances and other sources....My guess, assuming a linear dose-response relationship, is that the contribution [of magnetic fields to cancer] could be greater by a factor of two." After a quick calculation and a few assumptions about exposed workers, he writes, "The total 'body count' is on the order of 2,000 cases of childhood cancer and 4,000 cases of adult cancer per year." We asked Carpenter, who is with the NY Department of Health (he previously served as the executive secretary of the PLP), about this doubling of the estimated risk for children. "Given all the considerations and caveats of the calculations, that's the logical implication of our report," he replied.

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Australia's Victoria State Electricity Commission ran the ad shown on the above left in the Melbourne *Sun* on March 8 to pressure the approval of a 220 kV line between Brunswick and Richmond (see *MWN*, July/August 1986). The text below the headlines reads: "Just one existing power line keeps the business heart of Melbourne running. If anything should happen to that line, much of the city area and thousands of homes in the eastern suburbs would be powerless. Every day about 350,000 people depend on that one line. No other city of our size in the world has such a threat hanging over it. We urgently need the new power line to safeguard eastern Melbourne from the possibility of a total electrical blackout. Every day that passes brings the nightmare closer." Nevertheless, opposition kept growing and, in late March, the state government canceled the line. A union official in Victoria told *Microwave*

News that, "It is most unlikely that any further overhead system will ever be built in urban areas in Australia."

As the headline at right, above, from the March 19 English tabloid *Today* shows, the Savitz study has arrived in the U.K. The news stories were prompted by a BBC documentary and by a Central Electricity Generating Board announcement (see p.4). On March 28, Cecil Parkinson, Secretary of State for Energy, condemned the documentary in Parliament, according to a report by *The Independent*: "I believe [it] was essentially a scare-mongering program."

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So much has been written about Dr. David Savitz and co-workers' epidemiological study that it is easy to forget that it has not yet been officially published: It is scheduled to appear in the July issue of the *American Journal of Epidemiology*. The companion New York State study on adults by the Battelle group will be in the same issue. We had heard that the journal had put the papers on a fast track, given the huge interest in the results, but a staffer at the journal refused to comment, saying that she did not want to single out any articles as more or less important than any others. The engineers who collaborated with the epidemiologists are also publishing papers on their extensive measurement surveys. The results of Dr. Bill Kaune's Battelle group were published late last year in *Bioelectromagnetics* (8, pp.315-335, 1987). Professors Frank Barnes and Howard Wachtel of the University of Colorado in Boulder have submitted their manuscript to the same journal—a publication date has not yet been set. Kaune, who left Battelle to go to the National Bureau of Standards (NBS), is returning to the ELF business and will join Mike Silva at Enertech Consultants, in Campbell, CA, in early

April. At the NBS, he was with the Electromagnetic Fields Division, working on broadband microwave metrology. Kaune is a member of EPRI's EMF exposure assessment advisory subcommittee.

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There was a face-off between Drs. **Jerry Phillips** of the Cancer Therapy & Research Foundation in San Antonio, TX, and **H.B. Graves**, chief scientist at Crowell & Moring, a law firm in Washington, DC, on March 17 at the **American Public Power Association** workshop in New Orleans. After reviewing the latest bioeffects studies, Phillips asked, "How do we determine whether the problem is a big one or...a small one?" He maintained that science will yield the answers because more and more researchers are becoming interested in bioelectromagnetics. Graves countered Phillips's arguments, observing that, "Some of the [EMF] effects are there and some of them fade out on closer examination." He concluded that, "The main science commissions...have [unanimously] said there's no persuasive scientific evidence of adverse health impacts."

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Over the last five years, we have featured extensive coverage of the state of **Florida's** efforts to write rules governing the siting of transmission lines. As we reported at the end of last year, just when the state Department of Environmental Regulation (DER) was about to propose EMF standards, the state court of appeals issued a decision which, contrary to previous rulings, found that power lines could be approved without DER action. Now, according to DER's Buck Oven, the rule-making job has been passed on to the state **Environmental Regulation Commission**, chaired by Robert Mandell, a developer/attorney from Orlando. Following a briefing at the commission's February 17 meeting, Mandell asked to hear from a number of expert witnesses – many of whom had already testified before the state EMF advisory panel. The next commission meeting is April 14-15. Meanwhile, the decision on **Florida Power Corp.'s** long-pending 500 kV line near Tampa is up to the governor and his cabinet. A decision was expected in March but has now been put off until April 26.

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Add Maryland to the list of states facing a power line dispute. The **Maryland People's Counsel (MPC)**, which represents the interests of residential electricity users, is seeking a consultant to guide the office through **hearings on a 500 kV power line** proposed by the Potomac Electric Power Co. (PEPCO). The 10-mile line would complete a loop around Washington, DC. According to MPC's Kirsten Burger, the agency is looking for someone with technical expertise to

provide testimony on the effects of power line magnetic fields. On January 22, a local zoning board approved PEPCO's line – provided that "the Public Service Commission finds that [it] will not endanger the health and safety of residents in the area." The **Brinkwood Community Association**, a citizens group opposing the line, requested the hearings and, although no official date has been set, they will probably take place this summer.

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In our March/April 1987 issue we outlined the then-forthcoming **World Health Organization/International Radiation Protection Association (WHO/IRPA) Environmental Health Criteria (No.69) on static and time-varying magnetic fields** (see also p.9). The printing was delayed and it has only recently appeared. In the U.S. you can order a copy for \$9.60 from WHO Publications Center USA, 49 Sheridan Ave., Albany, NY 12210. Most other countries also have their own retail outlets for WHO reports.

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"Power Lines and Cancer?" will be the subject of the opening session of the **Electromagnetic Energy Policy Alliance's (EEPA) annual meeting, *Full Spectrum Electrophobia: DC to Daylight***. Among the scheduled speakers will be Drs. John Bergeron, David Carpenter, Edwin Carstensen and Philip Cole. For more information on the meeting, which will be held in Alexandria, VA, April 20-22, contact: EEPA Executive Director Richard Ekfelt, (202) 452-1070.

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Articles on **ELF health risks** continue to proliferate in broad-based and in specialized publications. For instance, the ***Journal of the American Medical Association*** ran an item, "Do Power Line-Generated EMFs Have Any Association with Certain Disorders?" in its February 26 edition. And the February 1 issue of ***Business Insurance*** considers the potential liability problem for electrical utilities and appliance manufacturers.

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## 100 Hz Sine Waves Transform Cells

A team of researchers at the Naval Medical Research Institute (NMRI) in Bethesda, MD, has reported that a 100 Hz sinusoidal electromagnetic field (EMF) can malignantly transform cells. If confirmed, the finding will add a new dimension to the ongoing debate on the cancer risk associated with exposure to extremely low frequency (ELF) fields.

In a paper presented at the *32nd Annual Meeting of the Biophysical Society* on March 2 in Phoenix, AZ, Dr. Abe Parola described how chick embryo fibroblasts exposed to a 7 G 100 Hz magnetic field for 24 hours were transformed, as determined by three independent experimental techniques. Parola's abstract explains that the effect was magnetic and not thermal.

Parola, who is with Ben-Gurion University of the Negev in Beer-Sheva, Israel, has been doing research at the NMRI for the last two years, using the same exposure system as the one used by Dr. Abe Liboff when he was at NMRI and whose results were reported in *Science* (223, pp.818-820, 1984). "It's one of the best ELF exposure systems around," Liboff told *Microwave News* from his office at Oakland University in Rochester, MI. He explained that the system's large coils guarantee uniform magnetic fields in the incubator.

Parola is scheduled to present these results at the *Annual Meeting of the Bioelectromagnetics Society*, to be held June 19-24 in Stamford, CT. He returned to Israel immediately after the Phoenix conference and could not be reached for comment. NMRI's Dr. Lutz Kiesow, a coauthor of the paper, did not return phone calls requesting comment.

Liboff said that, although it was not mentioned in the abstract, Parola had told him in Phoenix that he had also observed transformation with an exposure of 100 mG.

Up to now, researchers have assumed that EMFs can *promote* the growth of cancer cells but not *transform* normal cells into a cancerous state. Parola is claiming that ELF fields can transform cells. If his experiments are replicated, they will undoubtedly magnify the potential health threat associated with exposure to ELF fields.

Not surprisingly, scientists who had read the abstract were intrigued, though a little skeptical pending the release of more information. For instance, Dr. Chris Cain of the VA Hospital in Loma Linda, CA, said that he is "very interested" in the paper but, for the moment, is withholding judgment until he can find out details about Parola's protocol – e.g., how long after exposure the cells were assayed.

Similarly, Dr. Jerry Phillips of the Cancer Therapy and Research Foundation in San Antonio, TX, told *Microwave News* that the paper is "of extreme interest and of obvious importance." He added that, "It is good as far as it goes," but cautioned that to document transformation, one must show: (1) loss of growth regulation; (2) loss of contact inhibition; and (3) ability to establish a tumor in a host. Parola has not yet reported this, he said.

## U.K.'s CEGB Steps Up Power Line Health Effects Research

The Central Electricity Generating Board (CEGB), which is responsible for the generation, transmission and distribution of electric power in the U.K., is adding £500,000 to its ongoing research effort on the health risks associated with electric and magnetic fields.

The board's major new initiative will be a study by "an independent epidemiological group" of all new diagnosed childhood cancer cases in England and Wales. The children's past exposures to magnetic fields will be estimated.

Other elements of the CEGB research plan include an assessment of both the home and work field exposures of its staff, using personal dosimeters, and an independent basic research program. The new projects will double – to £1 million – the board's research budget on electromagnetic fields in the coming year, according to Dr. Peter Chester, the CEGB's director of environmental affairs.

The board is currently sponsoring health studies at the University of Leeds, the University of Manchester and the county health departments in Yorkshire and Lancashire. Dr. Robin Cox, the CEGB's chief medical officer, said that preliminary findings of an ongoing study on power lines and childhood cancer showed no association. The results of a companion adult leukemia study are expected next year.

Cox added that none of the board's studies have found any ill effects due to power lines: "On the evidence to date,

### NCI Study on Childhood Cancer Will Include EMFs

The National Cancer Institute (NCI) is planning a major study on the etiology of childhood cancer, to include an investigation of the role of a number of factors including electromagnetic fields (EMFs).

A spokeswoman for the institute told *Microwave News* that an advisory group will be formed to design the study protocol. "Magnetic fields will be one of the major components of the study," she said, adding that nothing else is definite at this time. Once the protocol is approved by the NCI Division of Cancer Etiology's Board of Scientific Counselors, a request for proposals will be issued.

According to a report in the March 11 *Cancer Letter*, the multi-center case control study would cost a total of \$2.8 million; the first year's expenses would be \$810,000. The children's residential exposures and the parents' occupational exposures would be estimated, along with the mothers' use of electrically-heated water beds and electric blankets during pregnancy.

no significant health risk to the public has been demonstrated from these fields." He said that the Savitz epidemiological study had shown "a weak association."

The CEEB announcement was released on March 17, a few days before the British Broadcasting Corp. (BBC) aired an investigative report on the health risks associated with power lines (see p.2).

For more information, contact: Dept. of Information and Public Affairs, CEEB, Sudbury House, 15 Newgate St., London EC1A 7AU, U.K., (01) 634-5111.

## **NY PSC Supports 1.6 kV/m and 100 mG Limits at ROW**

The New York Public Service Commission (PSC) will preserve its 1978 interim 1.6 kV/m electric field standard along the edge of power line rights-of-way (ROWs) and has endorsed the development of a companion magnetic field standard. In addition, the PSC has backed a study on childhood cancer and electromagnetic fields (EMFs) in New York state, as well as other types of power line research.

On February 24, the PSC approved these and other recommendations made in its January 11 task force report, which reviewed the findings of the NY Power Lines Project (PLP), issued last July (see *MWN*, July/August 1987).

With respect to magnetic fields, the task force concluded that the PLP's research findings "revealed no evidence that magnetic fields pose a health hazard." Dr. Daniel Driscoll, chairman of the task force, told *Microwave News* that the Savitz epidemiological study in particular showed "no causal link" between magnetic fields and childhood cancer.

Driscoll noted that, "The research gave [the task force] cause for concern" but did not call for a course of action that would "disrupt industry around the country."

In a telephone interview, Dr. David Carpenter of the NY Department of Health (DOH), who serves as executive secretary of the PLP, said that he does not agree with some of the task force's language. "To a degree, the PSC's response is very conservative, but probably not inappropriate," given the concern over economic disruptions.

The task force suggested a magnetic field limit of 100 mG at the edge of the ROWs and recommended that, "If a magnetic field limit is adopted, it should be made clear that magnetic fields have not been shown to be hazardous and that the purpose of the limit is to ensure that exposures...would be no greater than those which society has implicitly accepted for the 345 kV lines operating for many years throughout New York state."

This is the same logic as that used by the PSC in 1978 for its electric field standard. The task force noted that there still is "not a more reasonable or precise method" for establishing an electric field limit and argued, therefore, that further research into the biological effects of EMFs produced by power lines is needed before a final safety determination can be made.

The task force cautioned that both the electric and magnetic field standards should be considered "interim" until further notice.

Carpenter anticipates that the 100 mG level will be revised downward in the future.

The PSC also approved the task force's recommendation to continue the suspension of 2% matching grants which promoted outdoor recreational and educational uses of power line ROWs. In addition, the PSC instructed the NY Power Authority (NYPA) to continue to bar residential development within 175 feet of the center of a 765 kV power line.

The task force made a number of recommendations for future research:

- The Department of Public Service (DPS), the PSC's parent agency, should support research on power line EMF effects – specifically, an epidemiological study of childhood cancer and magnetic field exposures in New York state. According to Driscoll, sources of funding have not yet been identified.
- A PSC staff group should be formed to monitor these studies; the group would be charged with periodically reviewing the interim field limitations and analyzing incoming data on EMFs and human health.
- The DPS should join with the NY DOH in encouraging the federal government to undertake "relevant" research. The DOH has already contacted the National Cancer Institute, the Department of Health and Human Services, the National Academy of Sciences and the National Science Foundation to urge further investigations.
- The DPS and the PSC should encourage additional multi-state research mediated by a nonpartisan federal agency, such as the National Association of Regulatory Utility Commissioners.
- NY state utilities should implement a program of surveying and measuring EMF exposures in the state – including field measurements of overhead and underground transmission and distribution lines; the utilities should also investigate alternative means of power use and delivery to reduce EMF exposures.

The NY PLP was initiated in 1980 in response to protests against the building of NYPA's 765 kV transmission line. State utilities agreed to fund a \$5 million research program on possible health hazards associated with power line-produced EMFs in exchange for a PSC guarantee exempting them from future payments in support of "any other program on the same subject in pending or future transmission line siting proceedings." According to Driscoll, by limiting its recommendations for future utility-supported studies to technical – rather than biological – research, the task force continues to honor this agreement.

For more information on the PSC task force recommendations, contact: Dr. Daniel Driscoll, Office of Energy Conservation & Environmental Planning, PSC, Three Empire State Plaza, Albany, NY 12223, (518) 474-5368. To receive future

mailings on the *Interim Transmission Line Magnetic Field Standard Proceedings*, submit a written request to John Kelliher, secretary, DPS, at the same address.

### Budgets for EMF Research Are Growing at EPRI

The Electric Power Research Institute (EPRI) plans to spend \$6 million for research on extremely low frequency (ELF) electric and magnetic fields (EMFs) in 1989 – more than triple its 1985 budget of \$1.7 million. EPRI has budgeted an additional \$6 million for 1990.

There has been no comparable growth at the Department of Energy, the other major source of funds for ELF field effects research. The Environmental Protection Agency and the U.S. Navy have eliminated most of their work on ELF bioeffects – except for the ecological studies near the Navy's Project ELF transmitter.

EPRI, in contrast, has increased its ELF budget dramatically in the past four years, as shown in the table below:

1985 —	\$1.7 million
1986 —	\$1.7 million
1987 —	\$2.7 million
1988 —	\$4.7 million
1989 —	\$6.0 million
1990 —	\$6.0 million

(As of November 1987, EPRI had allocated only \$3.2 million for research on EMFs in 1988.)

These budget statistics appear in EPRI's *Research & Development Program Plan 1988-1990*, dated January 1988. According to the plan, EPRI's goals for the next three years are as follows:

- By 1989, provide measurement methods and equipment to assess exposure of workers and the public;
- By 1990, provide data, analyses and methods to identify potential health effects, significant levels of exposure and mechanisms of biological action that may be associated with electric and magnetic fields;
- By 1990, provide data to characterize the magnitude, range and time variation of magnetic fields, pinpoint field sources and relate field characteristics to these sources;
- By 1991, provide production-grade software that predicts magnetic fields;
- By 1991, transfer exposure data base to utilities and publish results of comprehensive exposure assessment of workers and the public.

Recently, EPRI announced the recipients of its basic science grants:

1) "Ultrastructure of Candidate Magnetic Sense Organs in Fish," Dr. Joseph Kirschvink, California Institute of Technology.

2) "Response of *Drosophila* and Human Cells to ELF EMFs," Drs. Reba Goodman and Ann Henderson, Columbia University and Hunter College, NY.

3) "ELF and Cancer Promotion – Studies on Cell Cultures and Mammary Tumors/Endocrine System in Rats," Drs. Shin Tsu Lu and Sol Michaelson, University of Rochester, NY.

The recipients were selected from 16 who submitted proposals. The contract periods are anticipated to be three years.

According to EPRI's Dr. Charles Rafferty, the precise terms of the contracts are in "the last stages of negotiation." Specific details on budgets and work to be performed were unavailable at press time.

For a copy of the *EPRI Research and Development Program Plan 1988-1990*, send \$10.00 (\$20.00 outside the U.S.) to: EPRI, Communications Services, PO Box 10412, Palo Alto, CA 94303, (415) 934-4212.

### IARC Meeting on ELF Fields and Cancer

The International Agency for Research on Cancer (IARC), a part of the World Health Organization, is planning a May 2-3 meeting in Lyon, France, on extremely low frequency (ELF) *Electromagnetic Fields and Cancer Risk*.

The workshop will focus on the current design of ELF epidemiological studies. In addition, it will explore the possibility of standardizing experimental protocols and measurement indices and coordinating the results of future projects.

Among those scheduled to discuss studies on ELF exposure assessment and occupational and residential risks are: Dr. Anders Ahlbom, National Institute of Environmental Medicine, Sweden; Drs. Joseph Bowman and David Garabrant, University of Southern California, U.S.; Dr. Jean-Paul Cabane, Electricité de France; Dr. Bengt Knave, Swedish National Institute of Occupational Health; Dr. Genevieve Matanoski, Johns Hopkins University, U.S.; Dr. Tony McMichael, University of Adelaide, Australia; Dr. Neil Pearce, National Health Statistics Center, New Zealand; Dr. David Savitz, University of North Carolina School of Public Health, U.S.; Dr. Stanley Sussman, Electric Power Research Institute, U.S.; and Dr. Gilles Thériault, McGill University, Canada.

IARC's Dr. Michel Coleman, who is organizing the workshop, hopes to assemble an IARC scientific publication that would provide an overall assessment of the cancer risk associated with exposures to ELF fields. For more information, contact: Dr. Michel Coleman, IARC, 150 Cours Albert-Thomas, 69372 Lyon Cedex 08, France.

# HIGHLIGHTS

## IRPA Shrugs Off VDT Radiation Health Risks

The International Radiation Protection Association (IRPA) discounts the radiation hazards associated with VDT work.

In a paper on "alleged" VDT radiation risks published in the February issue of *Health Physics*, IRPA's international non-ionizing radiation committee (INIRC) concludes that, "There are no health hazards associated with radiation or fields from [VDTs]," and that, "There is no scientific basis to justify shielding or radiation monitoring of [VDTs]." IRPA is a non-governmental group; many of its guidelines are issued jointly with the World Health Organization (WHO).

The references accompanying the IRPA paper are mostly from 1984. There are no citations to the Swedish radiation studies on pregnant mice (see *MWN*, March/April and May/June 1986 and July/August 1987) or to the Spanish chick egg experiments (see p.1), both of which have been at the center of an often-heated debate about pregnancy risks and VDT work.

IRPA's view differs from that of a WHO panel, which, in a 1986 paper (one of the two post-1984 references included in IRPA's review), discouraged VDT operators from working within one meter of the rear or sides of nearby terminals unless the units had been tested to check radiation emissions (see *MWN*, January/February 1987).

The IRPA/INIRC panel does suggest that more research on skin disorders and on the effects of low-frequency magnetic fields is in order because "a large number of people are involved" in VDT work.

Interestingly, Dr. Bengt Knave of the Swedish National Institute of Occupational Health, a member of the IRPA panel, presented a paper at a conference in August 1987 which contains the same conclusion – nearly word-for-word as that of the IRPA/INIRC (see *Social, Ergonomic and Stress Aspects of Work with Computers*, edited by G. Salvendy et al., pp.83-86, New York, NY: Elsevier, 1987). Knave was one of the principal organizers of the 1986 VDT conference, at which Swedish researchers presented the first data showing that VDT-type magnetic fields can have a deleterious effect on the developing mouse embryo.

In a paper published in 1985, panel member Dr. Michael Repacholi of the Royal Adelaide Hospital in South Australia reviewed the research from Dr. Jocelyne Leal's laboratory in Madrid, Spain (see *Australasian Physical and Engineering Sciences in Medicine*, 8, pp.51-61, 1985, and *MWN*, May/June 1986). A third panel member, the F.R.G.'s Dr. J. Bernhardt, is on the advisory committee to the Ontario Hydro/IBM-sponsored team at the University of Toronto, which is in the process of conducting a major mouse embryo radiation study (see *MWN*, September/October 1987).

The other members of the IRPA/INIRC panel are: Drs. H.

Jammet (chairman), France; B. Bosnjakovic, The Netherlands; P. Czerski, U.S.; M. Grandolfo, Italy; D. Harder, F.R.G.; J. Marshall, U.K.; D. Sliney, U.S.; and J. Stolwijk, U.S.

## Microwaves in Moscow

The beaming of microwaves at the U.S. embassy in Moscow continues, albeit at relatively low levels.

In a March 3 statement issued in response to questions from Barton Reppert of the Associated Press (AP), the U.S. State Department acknowledged that radiation – "primarily" in the 9-11 GHz range, with some in the 5-6 GHz range – is being detected at the Moscow embassy chancery at "typical" power levels of 0.1  $\mu\text{W}/\text{cm}^2$  outside the building and 0.01  $\mu\text{W}/\text{cm}^2$  inside. The signals are "usually on for a couple of hours a day" and are "rarely detected during the nighttime hours," according to the statement.

The last report of microwaves from Moscow was in the fall of 1983 when power densities of 2  $\mu\text{W}/\text{cm}^2$  were measured outside the embassy. At that time, the U.S. ambassador, Arthur Hartman, denied that there was any health risk but filed a formal protest with the Soviet Foreign Ministry "as a matter of principle" (see *MWN*, December 1983).

It is not clear whether the Moscow signal was turned off after the 1983 incident or continued to be beamed at the embassy. State Department spokeswoman Phyllis Oakley told the AP that, "We have watched the situation carefully. We continue to watch it carefully. There have been low levels that we have detected, but these pose no risk."

The State Department refused to comment on the reason for the transmissions, "because any response would be speculation." Since the microwaves were first detected in 1953, many explanations have been offered, though none has won official backing. The possibilities include activating listening devices, manipulating employee behavior and convincing American scientists that non-ionizing radiation is biologically active. In 1976, protective screens were installed on the windows at the embassy.

In his 1978 epidemiological study of Moscow embassy employees, Professor Abraham Lilienfeld of Johns Hopkins University urged the State Department to continue to monitor the health of the embassy staff in Moscow and in other cities (see *MWN*, January 1981). The State Department told the AP that for the last six years, researchers at the Biostatistics Center of George Washington University in Washington, DC, have been maintaining a computerized Medical Information Management System for overseas employees.

The State Department also said that radiation measurements at the new office building complex, which has been at the center of a controversy over Soviet listening equipment, were very low – levels that "one would expect to find in any major city."



### **EMP Threat to Power Grid Questioned**

The electromagnetic pulse (EMP) that would accompany a single high-altitude nuclear detonation would do minimal damage to the U.S. electrical power grid, according to Mario Rabinowitz of the Electric Power Research Institute (EPRI). In a recent report, he finds that previous predictions of severe grid damage were wrong primarily because estimates of peak pulse power were too high.

"As a result of present protection techniques, little or no [EMP] damage is expected for power plant equipment, substation equipment or power lines," Rabinowitz concludes, cautioning only that, "Although a solid case is made that the EMP cannot produce a national blackout, it has not been determined whether the EMP could produce a local regional blackout near the bomb burst."

Rabinowitz calculates the maximum electrical field generated by a high-altitude EMP to be approximately 12 kV/m, less than one-quarter of the previously suggested 50 kV/m maximum. This sizable difference is the result of his assumption that ionization from the detonation "severely attenuates" the pulse. The field strength—and the resulting harmful impact—would be approximately the same as that from a single stroke of lightning, he believes. (Rabinowitz excludes solid-state electronic circuits from his calculation.) Challenging other previous hypotheses, Rabinowitz reports that, "Concurrent multiple bomb bursts will not have an additive...effect, but will in fact interfere to produce less...than from a single burst."

This low-impact scenario is the latest twist in the long-standing EMP debate. During one of the last U.S. atmospheric nuclear tests, in 1962, EMP was suspected of disrupting power lines, opening circuit breakers, triggering burglar alarms and shutting off street lights in Hawaii. Rabinowitz challenges these reports, stating that these effects "cannot be substantiated."

Not surprisingly, Rabinowitz has attracted critics who challenge his methodology, his scientific reasoning and his understanding of EMP effects. Last fall, Rabinowitz published a paper—almost identical to the EPRI report—in the *IEEE Transactions on Power Delivery*, which was followed by 16 sets of comments.

Among the generally critical observations are those of Dr. Conrad Longmire of the Mission Research Corp. in Santa Barbara, CA, a leading EMP expert. Longmire finds that Rabinowitz's argument is "logically and technically flawed" and therefore "his conclusions are not justified." Similarly, Dr. Frederick Tesche of LuTech, Inc., in Dallas, TX, agrees, charging that Rabinowitz has oversimplified his analysis. Furthermore, Drs. B.W. McConnel and P.R. Barnes of the Oak Ridge National Laboratory in Oak Ridge, TN, state that, "[The] paper presents no experimental data to support the conclusions reached. The impact of EMP on power systems is simply not known at this time."

In his detailed response to the numerous questions raised about his work, Rabinowitz countercharges that millions of dollars worth of federally-funded research has failed to show that an EMP-related effect of serious proportions would occur. He specifically cites work done at Oak Ridge, which "has yet to demonstrate any appreciable effect." To back his conclusion that an EMP poses no grave danger to the electrical distribution system, he refers to statements made by officials of the Defense Nuclear Agency that downplay the risk of a widespread impact.

In a related paper, Tesche compares modeling systems for estimating the effects of EMP on overhead power lines. His work was done under subcontract to Oak Ridge and was sponsored in part by the Department of Energy.

A copy of Rabinowitz's *The Nuclear Electromagnetic Pulse and the Electric Power Grid: A Different Perspective* (EPRI EL-4351-SR), October 1987, is available for \$32.50 from Research Reports Center, Box 50490, Palo Alto, CA 94303, (415) 965-4081. See also Rabinowitz's "Effect of the Fast Nuclear Electromagnetic Pulse on the Electric Power Grid Nationwide: A Different View," *IEEE Transactions on Power Delivery*, 2, pp.1199-1222 (includes comments and responses), October 1987, and F.M. Tesche's "A Study of Overhead Line Responses to High-Altitude Electromagnetic Pulse Environments," *EMP Interaction Note 458*, December 1986.

### **Navy Technician Wins \$131,000 Out-of-Court Settlement**

Joseph Coatney, a former U.S. Navy radar technician who developed cataracts, won an out-of-court \$131,000 settlement from six radar manufacturers, according to his attorney, John Sweeney of Sweeney & Pafundi in Westlake Village, CA.

Sweeney related the following details of Coatney's story to *Microwave News*:

Beginning in September 1969, Joseph Coatney, then 18-years-old, served aboard the USS Springfield, a guided missile cruiser. For two years, Coatney was regularly exposed to radiation from surface, air-search and fire-control radars. Six years later, at the age of 24, Coatney was diagnosed as having bilateral, posterior, subcapsular cataracts and subsequently had corrective surgery. There was no history of cataracts in Coatney's family.

In 1981, while researching government reports in an effort to find out the cause of his cataracts, Coatney received an anonymous telephone call from a Food and Drug Administration employee. She said that she was contacting him out of personal concern for his condition. She told Coatney that his eye problems were common to many military personnel exposed to radar radiation. She also put him in touch with the Radar Victims Network, then led by Joe Towne, who himself had developed cataracts and other ailments.

In August 1982, Coatney sued Hughes Aircraft, Westinghouse, Raytheon, Sperry, General Electric and Sylvania and also named General Dynamics, the general contractor for the Springfield. Coatney contended that all of the manufacturers of the ship's radar equipment shared responsibility for his condition—it was difficult to



determine the extent of each manufacturer's contribution to his condition.

Just before Coatney's scheduled trial date in August 1987, the \$131,000 settlement was reached. General Dynamics contributed only a small amount to the award.

Most radar compensation cases are settled out-of-court, with a stipulation that the terms of the agreement be kept confidential. Nevertheless, details on some of these cases have leaked out. In 1981, Ronald Karras won a \$200,000 settlement from General Electric and Western Electric for multiple injuries (see *MWN*, July/August 1981). That same year, Leo

Foley settled his claim for \$25,000 against General Electric, Hughes Aircraft, Hazeltine, Lockheed Aircraft, Philco-Ford, Raytheon and Telerad-Lionel (see *MWN*, November 1981). And in 1982, Joseph Kerch received \$30,000 from Air America for cataracts caused by radar and navigational equipment (see *MWN*, December 1982).

Sweeney also reported that Roy Josey won \$171,000 from the U.S. Air Force in 1970 for radiation-induced cataracts. In addition, Towne – who died in 1985 – was awarded a \$55,000 settlement and, although barred from revealing the figure, he never shied away from sharing this information (see *MWN*, January/February 1986).

## FROM THE FIELD

### Draft IRPA Exposure Limits for ELF EMFs

*Reprinted below are the draft Guidelines on Limits of Exposure to Electric and Magnetic Fields at Power Frequencies of 50/60 Hz, proposed by the International Non-Ionizing Radiation Committee of the International Radiation Protection Association (INIRC/IRPA). The review draft, dated May 12, 1987, has two appendices with rationales for the electric and magnetic field limits. Much of these is based on two previous IRPA documents on extremely low frequency (ELF) fields and on magnetic fields (see p.3, and *MWN*, December 1984 and March/April 1987, respectively). The draft also features a list of 22 references – half pre-1980 and half post-1980.*

*The INIRC/IRPA argues that: "The epidemiological studies... suggesting a relationship between childhood or adult cancer and residence in houses at various distances from high current flow due to external electrical wiring configurations, cannot be considered in a health risk evaluation, because of the many deficiencies inherent in these studies. Several studies analyzing the incidence of cancer or mortality from cancer among arbitrarily defined occupational groups exposed to electromagnetic fields (among other factors) suggested an association between 'electrical occupations' and cancer. Because of the inherent uncertainty associated with this type of epidemiological study, and the lack of measurement of exposure, no definite conclusion can be drawn. The questions raised by these reports are serious enough to necessitate further investigation." The only two epidemiological studies listed in the references are the 1979 and 1982 studies by Dr. Nancy Wertheimer and Ed Leeper.*

*The members of the INIRC/IRPA that drafted the guidelines are: Drs. H. Jammet (chairman), France; J. Bernhardt, F.R.G.; B. Bosnjakovic, The Netherlands; P. Czerski, U.S.; M. Grandolfo, Italy; D. Harder, F.R.G.; B. Knave, Sweden; J. Marshall, U.K.; M. Repacholi, Australia; D. Sliney, U.S.; and J. Stolwijk, U.S. For more information, contact: A.S. Duchêne, scientific secretary, IRPA/INIRC, Institut de Protection et de Sécurité Nucléaire, Département de Protection Sanitaire, BP No.6, 92265 Fontenay-aux-Roses Cedex, France.*

These limits apply to human exposure to E- and H-fields at frequencies of 50 or 60 Hz, and may be applied to the power frequency of 16.6 Hz. These limits should not be applied to ELF frequencies above 60 Hz.

#### General Public

**Electric Fields:** The general public should not be exposed to rms unperturbed E-field strengths above 10 kV/m. Short-term exposure (hours/day) to 10 kV/m is acceptable, however continuous exposure

(24 hours/day) should be limited to rms fields less than 5 kV/m. Buildings intended for the use of members of the general public or for habitation should be erected only in a location where the unperturbed E-field strength outside the building 1.5 m above the ground and not less than 1.5 m from the building does not exceed 5 kV/m. The same restriction applies to open space areas where members of the general public might reasonably be expected to spend a substantial part of the day, such as recreational areas, sport facilities, meeting grounds and similar.

**Magnetic Fields:** The general public should not be exposed to rms H-field strengths above 0.2 mT.

#### Occupational

**Electric Fields:** Occupational exposure should not exceed 30 kV/m. For rms field strengths ranging from 20 to 30 kV/m the duration of exposure should be limited as much as possible. It is recommended that the duration of such exposure does not exceed 2 hours/day, and that during the remaining portion of the workday the exposure levels be reduced to 10 kV/m. A continuous occupational exposure up to 10 kV/m is permitted.

**Magnetic Fields:** Continuous occupational exposure should not exceed a rms value of 5 mT. For shorter durations (up to 2 hours/workday) exposure levels up to 10 mT can be permitted. For exposure restricted to the limbs values up to 25 mT can be permitted.

#### Measurement

For measurement of the E-field strength, free-field probes that measure fields undistorted by objects (the so-called unperturbed fields) at points 1.5 m from the ground are recommended....To determine compliance with the exposure limits, the E- and H-field strengths should be determined in accordance with recommended practices....In particular, the E-field component should be determined at a distance of 1.5 m from dielectrics and at a height of 1.5 m from the ground, and for inhomogeneous H-fields the H-flux density should be averaged on a loop surface of 100 cm<sup>2</sup>.

#### Concluding Remarks

The above guidelines will be subjected to periodic revision and amendment with advances in knowledge and identification of effects associated with particular frequencies and/or modes of generation.

## FROM THE FIELD

### Vernon, NJ: Cluster Continues

*During the last five years, we have reported on the continuing controversy of the cluster of Down's syndrome and other genetic defects among babies born to residents of Vernon, NJ. (See MWN, November 1982, September 1984, May and November/December 1985 and July/August 1986.) In the letter reprinted below, Dr. Robert Becker, formerly a professor at the State University of New York Upstate Medical Center in Syracuse, and now a consultant, writes that the cluster continues to grow.*

There appears to be a misconception as to the current status of the incidence of genetic defects in Vernon, NJ. It is frequently stated that no new cases have occurred since January 1, 1985, and, since the number of microwave sources in the town has steadily increased since the late 1970s, there can be no causal relationship between the levels of microwaves and such defects. I have assisted the citizens' group, CAT, in collecting and evaluating data since 1981, and am familiar with the current situation. In 1986, one case of Down's syndrome was born. In 1987, there were two other Down's births (one Trisomy 21, the other T 13), as well as one other child born with major defects in 3 chromosomes.

The yearly incidence of proven genetic defects in Vernon reveals a possible periodicity of occurrence. The following table lists the 17 cases (Down's-11, Edward's-2 and other chromosomal anomalies-4) by year of birth.

1975—2	1979—3	1982—1	1985—0
1976—0	1980—2	1983—1	1986—1
1977—0	1981—2	1984—1	1987—3
1978—1			

If a periodicity does exist and a peak was reached in 1980, it is possible that the cases occurring in 1986 and 1987 represent the beginning of a second peak in incidence. In any event, the data may be interpreted to indicate the following: First, an overage of genetic defects does exist in Vernon (expected number: 3.4 cases; actual number: 17—approximately a 500% excess since 1975). It should be noted that these data were gathered by voluntary reporting to the citizens' group; the actual incidence is likely higher than these figures indicate. Second, the situation in Vernon has not gone away, the genetic disease incidence is again on the rise. Third, there is not a direct linear relationship between the field strength of the microwaves and the incidence of genetic abnormalities. This suggests that the microwaves may be a cofactor and a second variable may be involved. At present I am attempting to evaluate the possible role of the geomagnetic field in this periodicity.

It is clearly evident that a health problem of considerable magnitude continues to exist in Vernon and may be related, at least in part, to the levels of microwave radiation present in the town.

Robert O. Becker, MD  
Star Route  
Lowville, NY 13367

### Ongoing Research on Power Line Electric and Magnetic Fields

The information below, current as of January 1, 1988, is adapted from a table assembled by Dr. Lee Rosen of W/L Associates, a consulting firm based in Frederick, MD.

Institution	Source	Exposure	Subjects	Comments
Argonne Natl. Lab.	DOE	E	Rodents	Characterization of circadian phase shifts.
Battelle Pacific NW Lab.	EPRI	E	Rodents	Immune stimulation—cellular and humoral.
	DOE	E	Rodents	Neuroendocrinology, tumor induction, behavior.
	DOE	E&M	In vitro	Characterization of membrane effects, oncogene studies, DNA sensitivity.
	EPRI	M	Humans	Use of E-blankets to test human pineal hormonal response.
Elect. Res. & Management	EPRI	M	Engineering	Addition of M-field to previously built E-field facilities for teratology.
Enertech Consultants	EPRI	M	Engineering	Exposure assessment instrumentation and software for computer modeling.
Johns Hopkins U.	EPRI	Occup.	Workers	Retrospective case control study of AT&T workers with field measurements.
Lawrence Berkeley Lab.	DOE	M	In vitro	Membrane studies, phase transitions.
McGill U.	OH & HQ*	Occup.	Workers	Use of records from Canadian and French utilities.
Midwest Res. Inst.	DOE	E&M	Humans	Acute exposure to continuous and intermittent fields.
SW Res. Inst.	DOE	E	Primates	Operant and social behavior.
Oakland U.	DOE	M	In vitro	Cyclotron resonance studies; calcium markers.
U. of North Carolina	EPRI	Occup.	Workers	Leukemia and brain cancer among electric utility workers.
U. of Rochester	DOE	E	Rodents	Operant behavior.
U. of the South	EPRI	E	Engineering	Scaling study related to cage conditions and the impact of animals on dosimetry.
U. of Southern CA	EPRI	Resid.	Children	Case control study of childhood leukemia.
	EPRI	M	Workers	Characterization of occupational exposures.
U.S. VA, Loma Linda, CA	DOE	E&M	In vitro	Characterization of cell membrane response to applied fields.
	DOE	E	Rodents	Evaluation of mechanisms of interaction to applied fields.

\* Ontario Hydro and Hydro Quebec

# UPDATES

## BIOLOGICAL EFFECTS

**Risks of Controlling Static...**An anti-static agent in plastic tote boxes was responsible for an outbreak of dermatitis among employees of a microelectronics firm, according to a NIOSH study by Dr. Diane Bennett and coworkers. The anti-static agent, bis-hydroxyethyl-tallow amine (BHETA), which was detectable as an oily film on the surfaces of the boxes, caused skin rashes on the hands and arms of 14 out of 29 of those working in direct contact with it. Employees also noted corrosion of electrical equipment stored in the treated boxes. Researchers investigating the problem concluded that BHE-TA is a strong skin irritant and a potential skin sensitizer. The study appeared in the *Journal of Occupational Medicine*, 30, pp.252-255, March 1988. For more information, contact: Dr. Toby Mathias, NIOSH, R-13, 4676 Columbia Pkwy, Cincinnati, OH 45226.

## COMPATIBILITY & INTERFERENCE

**Thiokol Fined for ESD-Sparked MX Fire...**A team of U.S. Air Force investigators has concluded that a December 29 MX missile explosion at a Morton Thiokol plant in Utah was caused by electrostatic discharge (ESD) or friction. The Utah Division of Occupational Safety and Health has fined Thiokol \$31,700 for "willful" and "serious" safety violations committed by the company and by the five workers who died in the fire. Thiokol officials say the company will appeal the fine (see *MWN*, September/October 1987 and January/February 1988).

**Tips for Fixing EMI...**The Electronics Industries Association (EIA) and the FCC have released a pamphlet, *Consumers Should Know Something About Interference: Tips on Searching It Out - and Some Fixes*. It explains the common types of EMI to consumer electronic products - TVs, VCRs, stereos and cordless phones - and how to resolve them. Copies are available from: Consumer Affairs, EIA, 2001 Eye St., NW, Washington, DC 20006; or from: Public Service Division, FCC, Room 725, 1919 M St., NW, Washington, DC 20554.

**Post Office EMC Tests...**The U.S. Postal Service (USPS) is seeking a contractor to perform EMI tests on six different types of stamp vending machines. The bidder chosen will determine whether the equipment meets military standards for conducted and radiated susceptibility in the 10 kHz to 1 GHz frequency range. Proposals for the one-year project were due April 18. For more information on solicitation No. 104230-88-B-0071, contact: C. Kennedy, USPS Headquarters, Office of Procurement, Room 1131, 475 L'Enfant Plaza West, SW, Washington, DC 20260, (202) 268-4103.

## MEETINGS

**BEMS Symposia...**In addition to the usual complement of papers, posters and workshops, the 10th Annual Meeting of

the Bioelectromagnetics Society (BEMS), to be held June 19-23 in Stamford, CT, will feature four symposia: (1) Microwave Hyperthermia for Cancer Treatment; (2) Use of Electric and Magnetic Fields for Tissue Healing; (3) Mechanisms of Interaction of Electric Fields with Cell Membranes; and (4) Behavioral and Physiological Effects of High Peak Power Microwave Pulses. The first two symposia have been approved for continuing medical education (CME) credit. The meeting will be held at the Westin Hotel, which is offering a \$58/night (single or double) discount rate for BEMS conferencees. To make a reservation, call: (800) 231-2042. For more information about the meeting, contact: BEMS Executive Director Dr. William Wisecup, 120 W. Church St., Frederick, MD 21701, (301) 663-4252.

**VDT Measurements...**The IEEE EMC Society's Working Group P1140 on *Near-Field Testing Procedures for Electric and Magnetic Fields* will meet on or around June 17 in Connecticut. The time and location will be set to coordinate with the BEMS meeting. The working group had originally planned to meet in March, but the session was canceled because Swedish researchers were unable to attend. On the agenda are reviews of spectral energy and time derivative methods, as well as a report from Finland. For more information, contact: Stephen Berger, Electro-Mechanics Co., 10620 Metric Blvd., Austin, TX 78758, (512) 835-4684. (See also *MWN*, July/August 1987.)

**HPM Weapons...**The 4th National Conference on High Power Microwave Technology for Defense Applications will be held at the U.S. Naval Post Graduate School in Monterey, CA, May 9-13. The objective of the conference is "to examine the service operational mission utility and weapons potential of high power microwaves" (HPM). Among the papers scheduled are a report on susceptibility measurements on an M1 tank and studies of avionics and the effects of HPMs on an artillery fuse. There will be a session on bioeffects, chaired by Dr. John de Lorge of the Naval Aerospace Medical Research Lab in Pensacola, FL, who will also review the behavioral effects of HPMs. Representing the other services, Howard Bassen will discuss the army's program and James Merritt will go over the USAF's research. Over 600 scientists and engineers attended the third HPM meeting in December 1986 (see *MWN*, January/February 1987 and January/February 1988). Attendees must have a "secret" security clearance. For more information, contact: Kindra Landry, American Defense Preparedness Association, Rosslyn Center, 1700 North Moore St., Suite 900, Arlington, VA 22209, (703) 522-1820.

**1989 Zurich EMC Symposium...**A call for papers has been issued for the 8th International Symposium and Technical Exhibition on Electromagnetic Compatibility, which will be held in Zurich, March 7-9, 1989. This biannual meeting attracts experts from all over the world: the 1987 symposium had 930 participants from 28 different countries. For more

## UPDATES

information, contact: Dr. T. Dvorak, ETH-Zentrum-IKT, CH-8092 Zurich, Switzerland, (1) 256-2790; or in the U.S., Dr. Ralph Showers, Dept. of Electrical Engineering, University of Pennsylvania, Philadelphia, PA 19104, (215) 898-8123.

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### MILITARY SYSTEMS

**Ideas for Weapons...**The Naval Surface Warfare Center (NSWC) and the Defense Advanced Research Projects Agency are accepting proposals "in microwave effects testing and compact source development" through June 30. Specifically, the proposed research should include experiments demonstrating "the enhanced effects of frequency modulation, multiple frequencies, waveform modulation and pulse shaping of microwaves on electronics systems." For more information, contact: Karen Jackson, Code S22, White Oak Laboratory, NSWC, 10901 New Hampshire Ave., Silver Spring, MD 20903.

**OTH-B Radar Operational...**The over-the-horizon backscatter (OTH-B) radar system, which can detect cruise missiles up to 2,000 miles away and "at ranges almost 10 times further than conventional ground-based radars," is now operating at limited capacity in Moscow, ME. The Electronic Systems Division of the USAF is now testing the system 12 hours/day, rather than full-time, due to software development problems. The radar, which transmits signals in the 5-28 MHz range, is expected to be fully operational next year when General Electric, the system's contractor, finishes work on the system's third sector and completes the software design. Another OTH-B is already under construction on the West Coast and the USAF has plans for one in Alaska and one in the Midwest - though these are now in doubt; in late March, a House subcommittee canceled the USAF's \$161 million request for OTH-B procurement....Meanwhile, the Navy is scheduled to move its relocatable over-the-horizon radar (ROTHR) from Virginia to Amchitka Island in the Aleutians to detect Soviet aircraft and ships. The USAF and the Navy will link their systems to "provide wide area surveillance," reports *Aviation Week* (March 21).

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### PEOPLE

The top EMF journals are going through changes. Dr. Don McRee of NIEHS was scheduled to become editor-in-chief of *Bioelectromagnetics* but had to decline due to time constraints. EPA's Dr. Richard Phillips will continue to run the journal, published by the Bioelectromagnetics Society, until a replacement is named. A search is also underway at *The Journal of Microwave Power and Electromagnetic Energy*, published by the International Microwave Power Institute (IMPI) - Dr. Geoffrey Voss of Voss Associates Engineering in Victoria, Canada, has resigned as the editor. And the officers of the Health Physics Society are not only looking for someone to replace Dr. Genevieve Roessler as the editor of

*Health Physics*, but also for a replacement for John Tolan, who is stepping down as editor of the society's *Newsletter*. At the *IEEE Transactions on EMC*, the succession is settled: Dr. Motohisa Kanda has taken over as editor from Richard Schulz, a consultant who retired from Xerox Corp. not long ago. In March, the first issue of *Microwave and Optical Technology Letters* will appear. Published ten times a year by Wiley-Interscience and edited by Professor Kai Chang of Texas A&M, the journal promises quick publication - no more than two-four months from time of submission. Another new publication is the quarterly *Journal of Electromagnetic Waves and Applications*, edited by J.A. Kong of MIT and published by VNU Science Press in The Netherlands.

A number of bioeffects and EMC researchers were recently named IEEE Fellows: Drs. Kenneth Foster of the University of Pennsylvania and Saul Rosenthal of Polytechnic University were elected for their work on bioeffects, and Ed Bronaugh of Electro-Metrics, Dr. Motohisa Kanda of NBS and Henry Ott of AT&T Bell Labs were named for their contributions to EMC studies....Stanley Salek, formerly with Circuit Research Labs in Tempe, AZ, has joined the NAB as a staff engineer....Franklin Jarman has been forced out as acting chief executive officer of Clini-Therm Corp., a manufacturer of hyperthermia treatment units. Charles Hill, a management consultant, is taking over on an interim basis.

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### STANDARDS

**CISPR Draft Rules...**CISPR subcommittees have released the following six-month draft rules: (1) *Limits and Methods of Measurement of Radio Interference Characteristics of Vehicles, Motor Boats, and Spark-Ignited Engine-Driven Devices*, CISPR/D(Central Office)17 (\$28.00); (2) Seven amendments to CISPR 14, *Limits and Methods of Measurement of Radio Interference Characteristics of Household Electrical Appliances, Portable Tools and Similar Electrical Apparatus*, CISPR/F(Central Office)44-50 (\$51.00 for the set); (3) Three amendments to CISPR 15, *Limits and Methods of Measurement of Radio Interference Characteristics of Fluorescent Lamps and Luminaires*, CISPR/F(Central Office)51-53 (\$23.00 for the set); and (4) Four amendments to CISPR 16, *CISPR Specifications for Radio Interference Measuring Apparatus and Measurement Methods*, CISPR/A(Central Office)42-45 (\$63.00 for the set). All are available (prepaid) from: ANSI, International Sales Department, 1430 Broadway, New York, NY 10018, (212) 642-4900.

**Radiated and Conducted Emissions...**ANSI has requested comments on drafts of a number of new and revised standards: (1) *Recommended Practice for the Measurement of RF Emissions from Industrial, Scientific and Medical Equipment Installed on User's Premises*, BSR/IEEE 139 (\$15.00); (2) A revision and redesignation of ANSI C16.25-1962, *Procedure for Measuring Conducted Emissions in the Range of 300 kHz*

to 25 MHz from FM and Television Broadcast Receivers to Power Lines (\$10.00); (3) A proposed revision of ANSI C63.4-1981, *Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronics Equipment in the Range of 10 kHz to 1 GHz*, BSR C63.4 (\$10.00); (4) *Calibration of Antennas Used for Radiated Emissions Measurements in Electromagnetic Interference (EMI) Control*, BSR C63.5 – methods for determining antenna factors for radiated emissions from 30 MHz to 1 GHz (\$10.00); (5) *Guide for the Computation of Errors in Open-Area Test Site Measurements*, BSR C63.6 – explanation of the basis of the  $\pm 4$  dB criterion for the site attenuation measurements required in C63.4 (\$6.00); and (6) *Guide for Construction of Open-Area Test Sites for Performing Radiated Emission Measurements*, BSR C63.7 – information on emissions in the range of 30-1000 MHz (\$8.00). The first two drafts are available from O. Edwards, and the others from Fred Huber, Jr., both at: IEEE, 345

East 47th St., New York, NY 10017.

**ETC...**

**Literature Review...** For its 22nd general assembly, held last summer in Tel Aviv, URSI prepared a *Review of Radio Science 1984-1986*. (Similar reviews were put together for its previous triennial meetings.) The volume, which was edited by Dr. Geoffrey Hyde of Comsat, covers all the major areas of communications, including EMI and bioeffects. The chapters on "EM Noise and Interference" and on "Bioeffects of EM Waves" were assembled by H. Kikuchi of Japan and Cesar Romero-Sierra of Canada, respectively. Each chapter features extensive references. A copy of the review is available for \$20.00, which includes surface postage, from: URSI, 3 Ave. Circulaire, B-1180 Brussels, Belgium.

## CONFERENCES

### New Listings

May 1-5: **3rd Annual High Frequency Power Conversion Conference**, Princess Resort Hotel, San Diego, CA. Contact: Intertec Communications, Inc., 2472 Eastman Ave., Bldg. #33-34, Ventura, CA 93003, (805) 658-0933.

May 9-13: **4th National Conference on High Power Microwave Technology for Defense Applications**, U.S. Naval Post Graduate School, Monterey, CA. Contact: Kindra Landry, American Defense Preparedness Association, Rosslyn Center, 1700 North Moore St., Suite 900, Arlington, VA 22209, (703) 522-1820.

May 12-17: **Spring Conference of the Society of Telecommunications Consultants (STC)**, Hyatt Regency Alicante Hotel, Garden Grove, CA. Contact: STC, 1841 Broadway, Suite 1203, New York, NY 10023, (212) 582-3909.

June 7-10: **Conference on Precision Electromagnetic Measurements (CPEM'88)**, Tsukuba Science Center, Japan. Contact: CPEM'88 Secretariat, 2-40-14, Hongo, Bunkyo-ku, Tokyo 113, Japan.

June 23-25: **2nd European Congress of NMR in Medicine and Biology**, Hotel Inter-Continental, Berlin, F.R.G. Contact: Dr. C.D. Claussen, Radiologische Klinik, Freie Universität Berlin, Spandauer Damm 130, 1000 Berlin 19, F.R.G., (030) 30 35-821.

June 25-26: **4th National Standing Conference on Low-Level Radiation and Health**, Stirling, Scotland, U.K. Contact: M. Crankshaw, 20 Reedloch Dr., Barrassie, Troon, KA10 6UK, Scotland, U.K., (0292) 316008.

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

October 16-20: **1988 Conference on Electrical Insulation and Dielectric Phenomena**, Skyline Hotel, Ottawa, Canada. Contact: Prof. Marshall Pace, Dept. of Electrical and Computer Engineering, University of Tennessee, Knoxville, TN 37996, (615) 974-5419.

November 9-11: **21st Annual Electronics and Aerospace Conference (EASCON 88)**, Hyatt Regency Crystal City, Arlington, VA. Contact: Wilbur Pritchard, SSE Telecom, 7200 Wisconsin Ave., Bethesda, MD 20814.

April 2-7, 1989: **1989 IEEE/PES Transmission and Distribution Conference and Exposition**, Convention Center, New Orleans, LA. Contact: Donald Preston, Louisiana Power & Light Co., PO Box 6008 (L-319), New Orleans, LA 70174, (504) 363-8735.

September 11-14, 1989: **Work with Display Units 89 (WWDU89)**, Queen Elizabeth Hotel, Montreal, Canada. Contact: WWDU89, Institut de Recherche en Santé et en Sécurité du Travail du Québec, 505 boul. de Maisonneuve Ouest, Montreal, Québec H3A 3C2, Canada, (514) 288-1551.

### Upcoming Meetings

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 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 25-27: **1988 IEEE MTT-S International Microwave Symposium**, New York, NY. Contact: Jesse Taub, LRW Associates, 1218 Balfour Dr., Arnold, MD 21012, (516) 595-4288.

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 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 Hotel & Towers, Boston, MA. Contact: HPS, 8000 Westpark Dr., Suite 400, McLean, VA 22102, (703) 790-1745.

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.

telephone interview, "The effect is real. It is produced by a low-level magnetic field, but we don't yet know what the important parameters of the field are."

Monahan's lab was one of the two in which a statistically significant increase in abnormalities was found. The other significant findings were reported by Dr. Alexander Martin of the University of Western Ontario in London, Canada.

Similarly, Dr. Ezra Berman of the Environmental Protection Agency (EPA) in Research Triangle Park, NC, who is coordinating the Henhouse project, told *Microwave News* that, "This study has contributed significantly to the growing data base implicating an association of PMFs of very low frequency and/or very low intensity in the increase of abnormalities in chick embryos."

Berman will discuss the Henhouse results at the *Annual Meeting of the Electromagnetic Energy Policy Alliance* on April 21 in Alexandria, VA, before making the official presentation at the BEMS meeting in Stamford, CT, June 19-24.

In addition to Leal, Martin and Monahan, the other Henhouse researchers are Drs. William Koch of the University of North Carolina (UNC) in Chapel Hill, Kjell Hansson Mild of the National Institute of Occupational Health in Umea, Sweden, and Graciela Martucci, formerly with the EPA in Las Vegas, NV.

The six research teams used identical equipment and similar experimental procedures; only the chick eggs came from different sources. Altogether, they ran a total of 60 experiments. The eggs were exposed to a 1  $\mu$ T PMF—each pulse had a 2  $\mu$ sec fall and rise time with a 500  $\mu$ sec duration—for the first 48 hours of incubation.

### **BEMS Henhouse Abstract**

The effect in chick embryos of exposure to pulsed magnetic fields (PMFs) was investigated by six independent laboratories in Europe, Canada, and the U.S. Each laboratory was identically equipped with incubators containing Helmholtz coils, electrical devices to develop and observe the pulse, and monitors of the temperature, relative humidity, and vibration of each incubator. Each laboratory conducted 10 runs of 20 eggs (10/sham or treated) exposed to unipolar pulsed magnetic fields (1  $\mu$ T, 500  $\mu$ s duration, 2  $\mu$ s rise and fall time, 100 Hz repetition) for the first 48 hours of incubation. Eggs were evaluated for fertility, and embryos for the presence of development, normal structure, and maturity. Two of six laboratories showed a significant ( $p < 0.001$  and  $p = 0.03$ ) increase in the proportion of abnormal embryos in the treated group, and so did the project as a whole ( $p = 0.001$ ). The interaction between treatment and laboratory where the experiment was conducted was significant ( $p = 0.015$ ) for the proportion of abnormal embryos. Statistical differences in the proportion of live embryos ( $p = 0.01$ ) and in their maturity, as measured by the number of somite pairs ( $p = 0.002$ ) and the Hamburger and Hamilton stage ( $p = 0.005$ ), were related to the laboratory and not to exposure. Apparently, very low-level, very low-frequency, pulsed magnetic fields contribute to increased abnormality incidences in early embryonic chicks without concomitant changes in maturity. (Supported by ONR and EPA.)

EPA's Ric Tell designed and built the exposure systems, which control all the major physical variables—for instance, temperature, humidity and mechanical stability. Tell, who last year left EPA to open his own consulting firm, told *Microwave News* that, "The Henhouse project probably represents one of the most carefully done experiments...aimed at exploring the biological effectiveness of weak PMFs."

Although the field affected the incidence of abnormalities among the developed embryos, it did not change the ratio of developed to non-developed (alive to dead) organisms or the rate of growth of the morphologically normal embryos. There is no clear explanation for the variation in the experimental results from the six labs.

Leal believes that genetic factors could explain some of the differences. For instance, she said that the one group that did not find an increase in abnormalities—Koch's team at UNC—used a breed of chick eggs which was genetically very different from that used by the other five labs. According to EPA's Berman, Koch exposed White Rock eggs, while the others used White Leghorn eggs. Leal pointed out that the new results reinforce what her group found some years ago—that weak PMFs are effective but that the biological response is modulated by "uncontrolled factors."

In addition, in a paper published last year, Leal and co-workers showed that the teratogenic effect of PMFs depended on the orientation of the chick embryos. They concluded that, "By changing their orientation, the embryos could escape the potential teratogenic effect of a field exposure on their development" (see *Medical Science Research*, 15, pp.531-532, 1987). In a previous paper, Leal's group reported on the influence of the Earth's magnetic field on the development of chick embryos (see *MWN*, January/February 1987).

The Spanish Ministry of Health is sponsoring a meeting for the members of the Henhouse project in Madrid, April 25-29. In addition to planning the next series of experiments, the researchers will discuss possible sources of funding to keep their research going—the ONR money has run out. IBM is considering funding the continued work of the project, according to a company spokesperson.

The impact of the Henhouse results on the debate over possible ill effects among pregnant VDT operators is as yet unclear. The type of PMF used by the Henhouse teams was different from that emitted by the flyback transformer in cathode ray tube-type VDTs, and a chick embryo is quite unlike a human fetus. Not surprisingly, most experts shied away from extrapolating the results to humans and VDTs. As Leal told *Microwave News* from Madrid, "Possible effects of VDT fields on the human fetus can only be known through an epidemiological study."

The spokesperson for IBM also cautioned against applying the chick egg results to other species—especially humans. She said that, "It would seem that the only prudent conclusion to draw at this time from the Henhouse investigation is that further research is needed to better understand electromagnetic fields."

Dave Janes, a division director at the Environmental Protection Agency (EPA) and the chairman of the C95.IV risk assessment group, compared the subcommittee to "a rudderless ship." Asked about the status of the revision of the health standard, Janes told *Microwave News*, "I haven't the foggiest notion in the world."

One of the clouds hanging over the members of C95 is the fear of personal liability if the standard is later contested in court. The Navy and the IEEE have so far refused to indemnify the working members from future legal challenges.

According to Dr. John Osepchuk of Raytheon, the secretary of C95.IV, this lack of protection was a factor in Storm's decision to resign. Indeed, in his letter of resignation, Storm, a hyperthermia specialist at the University of Wisconsin in Madison, advised Rosenthal to consider appointing a chairman of C95.IV from the ranks of industry – and thus protected by his or her company – since "the chairman will be the first-named in a lawsuit against the committee."

Nevertheless, Rosenthal appointed Drs. Om Gandhi of the University of Utah in Salt Lake City and Eleanor Adair of the John Pierce Foundation in New Haven, CT, as interim co-chairs of C95.IV until a new chairman of C95 is appointed.

In a telephone interview, Gandhi said that, "The first order of business is to get some kind of liability insurance for the members." Gandhi believes that over two-thirds of the subcommittee are concerned over liability: "Realistically, concrete action cannot be taken until the liability cloud is lifted."

### An IEEE Committee

The most likely solution to the legal dilemma is for C95 to become an IEEE committee. Gandhi said that a petition to the IEEE is being drafted. According to Rosenthal, the petition will be forwarded to the IEEE Standards Board for its June meeting.

Henry Bachman, the past president of the IEEE and a vice president at Hazeltine Corp., said that he would welcome the committee because the radiation issue is of direct relevance to the institute. But, as Andy Salem, the director of standards at the IEEE, pointed out to *Microwave News*, C95 would have to operate under IEEE procedures: "They will have to decide whether to trade their independence for good management."

If C95 does become an IEEE committee, its members will be indemnified, Salem said. However, he added that it is out of the question for the institute to provide funds for the committee's operation – that is up to industries and organizations which have an interest in the standard.

No one anticipates any progress on the revision until the C95 organizational problems are worked out. As Dr. Max Weiss of AT&T Bell Labs said, "Until the bureaucratic situation is resolved, we can't do very much."

Under ANSI's rules, all standards must be revised or reaffirmed every five years. The ANSI C95.1-1982 guidelines are thus already technically out-of-date.

Frustration among the C95.IV membership has mounted since 1983, when Storm first set up a complex system of

committees, subcommittees and working groups to evaluate the RF/MW bioeffects literature (see *MWN*, July/August 1983). The following year, complaints were already surfacing over the unwieldy structure and slow pace of the revision process (see *MWN*, October 1984). After entering the maze for review, some papers seemed to disappear.

Nothing changed, however, and two years later, in Madison, WI, the debate became tense as proposed revisions were announced before the literature review was complete. Many subcommittee members balked at having to vote on the proposals (see *MWN*, July/August 1986).

In Madison, some C95.IV members refused to vote, citing their concerns over personal liability after Navy and IEEE staffers warned that they would not offer them indemnity. Since then, progress has been imperceptible. Storm did not attend last year's C95.IV meeting in Portland, OR.

In numerous interviews, many C95.IV members said they did not know the status of the revision. "As far as I am aware, no progress has been made since June 1987, and, if progress has been made, it has not been communicated to the subcommittee," said Jack Monahan, the C95.IV representative of the Food and Drug Administration's Center for Devices and Radiological Health.

Dr. Barbara Chang, chief of hematology and oncology at the VA Medical Center in Atlanta, GA, quit out of frustration over the group's disorganization. In her February 18 letter of resignation, Chang, one of the few medical doctors active on C95.IV, complained that, "Not only have we not received all of the articles we should have received in a timely fashion, but an organized effort at obtaining our reviews in a systematic, uniform manner has not been undertaken."

### Substantive Issues

Once the organizational details are worked out, the C95.IV members must grapple with a host of equally complex technical and policy questions. For instance, the subcommittee still has not decided whether to adopt a two-tier standard with different limits for the general population and for workers – like the one recommended by the National Council on Radiation Protection and Measurements (NCRP). The 1982 ANSI guidelines applied the same limits to both groups. Also, there are proposals to extend the applicability of the standard down to 3 kHz and up to 300 GHz. At present, it only covers the 300 kHz-100 GHz frequency band.

The appointment of Gandhi as interim cochair will complicate the negotiations over loosening the 1982 limits at millimeter wave frequencies. In 1986, a proposal was offered to double the standard to 10 mW/cm<sup>2</sup> above 3 GHz – apparently to conform to infrared radiation exposure limits (see *MWN*, July/August 1986). But Gandhi has strongly criticized this change, arguing that millimeter waves and infrared radiation are very different because the former can penetrate clothing while the latter cannot. Asked whether he will maintain his opposition to relaxing the standard at higher frequencies, Gandhi replied, "Of course. I'm not giving up science."



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