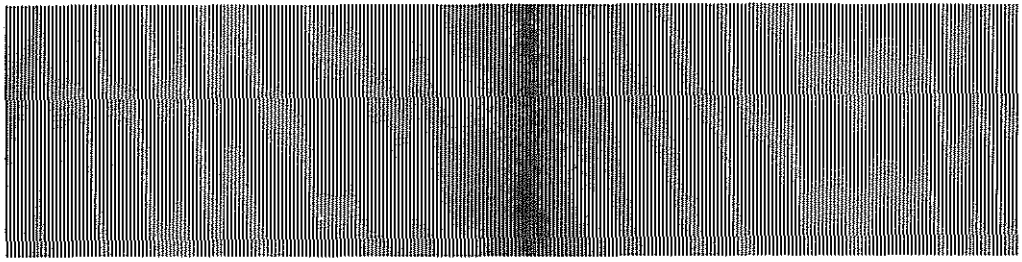


MICRO WAVE NEWS



Vol. IX No. 2

A Report on Non-Ionizing Radiation

March/April 1989

INSIDE...

HIGHLIGHTS pp.2-4

Commerce & FCC Seek EPA RF/MW Rules
DOD Launches Inter-Service EMI Study
Navy Signals Jam Garage Door Openers
Higher Cancer Rates Near Sutro TV Tower
FCC's New EMI Measurements Proposal
EPA Measures RF in McFarland, CA
U.S.S.R. Meetings on NIER

ELF NEWS pp.5-10

Power Line Talk
Swedish Academy of Sciences Workshop
EPRI 1989-1991 Budget: \$21.9 Million
Epi Studies: "Consistency" in Cancer Risk
Power Line Actions Across the U.S.:
Oregon • Washington • New York •
California • Maryland • Virginia
NY Dept. of Health on Electric Blankets
HVDC and Agricultural Study: No Effects
ELF and Power Line Resources
Florida EMF Standards: Table p.13
Florida DER-ERC Resolution p.14

UPDATES pp. 11-13

AMA on PEMF Stimulation • Statisticians
Meeting on Power Line EMFs • USAF To
Prepare EIS on NJ Transmitter Site • FCC's
Q's & A's on RF Bioeffects • Measurement
Briefs • Miniature Radio Transmitters May
Harm Owls • Assessing EEDs for EMI •
MW Weapons Conference • More on
Incomplete MW Cooking • New from NIST
• ELF and Power Line Meetings • FDA's
TEPRSSC Committee Openings • CU Rates
MW Ovens • and more....

COMMENTARY p. 15

Revising the 1982 ANSI RF/MW Limits

CONFERENCES p.16

New Listings

NAS-NRC: Skepticism over ELF Effects Without a Mechanism

At a March 14 workshop, members of a panel convened by the National Academy of Sciences-National Research Council (NAS-NRC) expressed skepticism about the possible role of weak extremely low frequency (ELF) fields in the development of cancer. "We have not seen good basic research that could explain the epidemiological findings," Dr. Richard Setlow, the chairman of the panel, said in a telephone interview after the meeting.

After six invited speakers presented an overview of current ELF research, the three physicists on the NAS-NRC panel—Drs. Robert Pound, Herman Schwan and Eugene Stanley—all expressed doubt that low-intensity fields could be responsible for the observed increases in cancer rates.

"Is there an effect?" Stanley asked rhetorically. For his part, he said that he is far from convinced. Stanley expressed his amazement at "the lack of coordination among studies," while acknowledging that the "main problem is a lack of funding." Nevertheless, he said that, "It's worth the agencies' money" to find out if there are health effects. He added that he would prefer science-based agencies like the National Institutes of Health and the National Science Foundation to sponsor ELF studies, rather than the Electric Power Research Institute (EPRI) and the Department of Defense, which have a stake in the results.

Those members of the panel with biological and epidemiological expertise had their own criticisms. For instance, Dr. Clark Heath described

(continued on p.14)

Florida Adopts First U.S. Power Line Magnetic Field Limits

Rules Are Challenged as Too Lax

The state of Florida has adopted the first power frequency magnetic field exposure standards in the United States. The magnetic field limits set by the state Department of Environmental Regulation (DER) are significantly weaker than those first proposed last year.

The standards, adopted at a January 18 public meeting, only apply to new transmission lines, but the regulations also specify more stringent limits for the 500 kV Lake Tarpon-Kathleen power line—the line is certified to operate at only 16% of its capacity, however.

"These are not health-based standards," the DER's Buck Oven told *Microwave News*. "Since at this point, we can't say what levels are safe, the standards are set on what is technologically achievable."

But residents of Hillsborough County—the site of the planned Lake

(continued on p.13)

HIGHLIGHTS

Commerce Department and FCC Seek EPA RF/MW Rules

The National Telecommunications and Information Administration (NTIA), an arm of the Department of Commerce, has joined the chorus of those agencies trying to convince the Environmental Protection Agency (EPA) to issue federal standards for public exposures to radiofrequency and microwave (RF/MW) radiation.

In a February 24 letter to EPA Administrator William Reilly, Assistant Secretary of Commerce Alfred Sikes argued that, "It is important and in the public interest that the EPA continue its RF radiation activities and issue federal guidance."

Also, the Federal Communications Commission (FCC) has again expressed its "disappointment" that the EPA will not issue RF/MW limits. In a March 14 letter to the EPA, FCC Chief Engineer Thomas Stanley asked the EPA to consider developing an official position on nongovernmental safety standards that either have been or will soon be issued: "It would be of great benefit to the FCC and other agencies if the EPA would offer advice on the interpretation and supportability of existing nongovernmental RF standards." Stanley explained that, "In the next two years, the FCC may have to reconsider which nongovernmental RF exposure standard to use."

Last November, FCC Chairman Dennis Patrick asked the EPA to reconsider its decision to defer its rules (see *MWN*, N/D88). The FCC, like the NTIA, is concerned that without federal rules, state and local governments will issue "unduly restrictive" exposure standards. In its January 23 response, the EPA offered no encouragement that RF/MW limits might be forthcoming, but did say that the agency may publish a "Citizen's Guide" to RF radiation.

Stanley asked in the March letter whether the proposed citizen's guide would offer clues as to "what are considered to be 'safe' exposure levels?" He went on to express concern that the "EPA will lose the expertise necessary to maintain the interagency agreement and satisfy future demands to measure and analyze environmental RF exposure."

NTIA's Letter

In NTIA's letter to the EPA, Sikes was relaying the concerns of the Frequency Management Advisory Council (FMAC), an NTIA advisory committee. At its November 14 meeting, FMAC was briefed by Richard Guimond, the director of EPA's Office of Radiation Programs, who had decided to put the RF/MW rules on hold after more than ten years of development (see *MWN*, S/O88 and J/F89). Also present was Dr. Charles Süsskind of the University of California at Berkeley, who maintains that there is a clear constituency for a uniform, nationwide standard.

Members of FMAC decided to send the letter to the newly-installed EPA administrator. Dr. Sam Koslov of the Johns

Hopkins University Applied Physics Lab was recruited to draft the letter, which advised the EPA that:

Authoritative federal criteria are needed both as a basis for assuring safety and to prevent the costly and disruptive effect that the proliferation of piecemeal and diverse exposure criteria and regulations are having on the telecommunications industry. The absence of such criteria also contributes to public apprehension, litigation and controversy over the safety of RFR [RF radiation] and radiating equipment. Furthermore, other countries, large and small, have established or are developing standards to control exposures to RFR. International bodies have also recommended guidelines. U.S. companies competing to provide equipment and telecommunications services in world markets face uncertainties in complying with diverse criteria established by other countries or international bodies. Without established U.S. criteria as a basis for leadership, the U.S. weakens its position.

We appreciate the demands of other important priorities competing for the limited budgetary and manpower resources available to EPA. However, considerable investment, effort and substantial progress have been made toward the issuance of RFR guidance by the EPA since the 1970s. Very little more is needed to complete the task at this stage as compared with the significant effort and additional resources that will be required to re-establish the activity later. We believe it is important and in the public interest that EPA continue its RF radiation activities and issue federal guidance.

DOD Launches Inter-Service EMI Study Project

The U.S. Department of Defense (DOD) has begun a three-year study of electromagnetic compatibility among electronic weapons systems used in the different branches of the military. The \$30 million joint electromagnetic interference (JEMI) study project is headed by the U.S. Air Force's (USAF) Colonel Charles Quisenberry of the Tactical Air Warfare Center at Eglin Air Force Base (AFB) in Florida.

Quisenberry, who recently completed a seven-month, classified JEMI feasibility study, has stated that the investigation was prompted by the unexplained crash of a USAF F-111 jet during the 1986 raid on Libya, according to a January 19 Knight-Ridder news service report. Quisenberry said that radiofrequency (RF) interference might have led to the downing of the F-111: "It could have. We couldn't rule it out or say that that was the cause," Knight-Ridder reported.

Speculation that EMI was responsible for the F-111 loss was further fueled by an account of the incident by former Secretary of the Navy John Lehman, Jr. in his recently-published book, *Command of the Seas*. Lehman wrote that Navy pilots saw the F-111 crash into the water off the coast of Libya and then explode, but there was no indication that it had been hit, the February 13 *Air Force Times* reported.

After a detailed investigation, the USAF determined that the crash and other unexplained problems during the raid were due to a flood of electronic signals from Navy and USAF high power transmitters intended to jam Libyan air defenses: "The end result was we found out [that] we did it to our-

Navy Signals Jam Automatic Garage Door Openers

For two weeks in March, a mysterious signal jammed hundreds of radio-controlled garage door openers in the San Francisco Bay Area. The puzzle was solved on March 16 when the U.S. Navy announced that the electromagnetic interference (EMI) was caused by shore-to-ship communications. The Navy stopped its transmissions on March 15.

Using an antenna atop Mount Diablo, the Navy was transmitting at 311.6 MHz, according to Lt. John Murphy, a spokesman at the San Francisco Naval Base. Garage door openers operate in the 308-312 MHz frequency band.

When news of the EMI got out, the Navy was besieged with calls. "I was even contacted by the British Broadcasting Corporation (BBC)," Murphy told *Microwave News*. Murphy believes that widespread interest was sparked by rumors that the source of the EMI was top secret. "The BBC even asked about a link with the [NASA] shuttle," he said. He added that the transmissions were not classified. The rumors were no doubt fueled by a Federal Communications Commission spokesman who refused to divulge which governmental agency was responsible for the interfering signals.

The Navy usually uses telephone lines to communicate with its docked ships, Murphy pointed out, but there was a break in the system, which has since been repaired. Alternative means are being investigated for the future, Murphy said. "We don't want to be a bad neighbor."

In 1986, a similar problem occurred in southern California when President Reagan's E-4B—a specially-equipped Boeing 747 to be used in the event of nuclear war—caused garage door openers to malfunction (see *MWN*, M/J86).

selfes," Quisenberry told Knight-Ridder.

A Pentagon spokesman, quoted in the February 13 *Air Force Times*, refuted Quisenberry's claims: "There is no indication...that EMI might have caused one of the fighters to crash and others to miss their targets, or that during the Libyan strike U.S. weapons were interfering with each other."

Quisenberry is no longer granting telephone interviews, a DOD spokeswoman told *Microwave News*.

The JEMI project, which is staffed by approximately 65 military and civilian experts at Eglin AFB, is the first major effort to investigate how RF signals from the weapons of one branch of the military might disrupt the electronics systems of another branch.

Among the goals of the project are to notify U.S. and allied commanders of potential problems and to recommend tactics to avoid them, either by assigning new frequencies to certain

transmitters or by assuring that interfering weapons are kept far enough apart to prevent EMI, according to Knight-Ridder.

Quisenberry has proposed using the U.S. Army's UH-60 Black Hawk helicopter as a case study, according to the December 19, 1988, *Aviation Week & Space Technology*. The Black Hawk has been identified as vulnerable to EMI and has been implicated in a number of possible EMI-related accidents (see *MWN*, N/D87, S/O88 and N/D88). Another Army helicopter under investigation for susceptibility to EMI is the AH-64 Apache. A June 20, 1988, report from the DOD Inspector General pointed out that simple solutions to EMI do not always work: coating the doors of the Apache with a metallic paint did not solve the problem.

The DOD hopes to institutionalize the JEMI project after the three-year investigation is concluded, according to the December 19 *Aviation Week*.

EMI among military systems has become national news: On February 27, *Time* ran an item on the PAVE PAWS radar at Robins AFB, GA—where the main beam of the phased array poses a threat to electro-explosive devices aboard aircraft flying into the base—under the headline, "A \$90 Million Mistake" (see *MWN*, J/A88, N/D88 and J/F89). The magazine also referred to the EMI problems plaguing the Black Hawk.

Higher Cancer Rates Near San Francisco's Sutro Tower

Between 1973 and 1985, in San Francisco's Noe and Eureka valleys, children under the age of 15 developed cancer at twice the expected rate for children in the Bay Area. The San Francisco Department of Public Health, which conducted a brief investigation, believes that the statistically significant increase (21 observed cases, as compared to 11.8 expected) may have occurred by chance. The department points out that there is no evidence of a continuing problem, since no new cases have been reported since 1986.

The search for the cause of the problem has yielded two potential candidates: radiofrequency (RF) radiation from the Mount Sutro tower—shared by five VHF and four UHF TV stations and four FM radio stations—atop Twin Peaks, which overlooks the Noe and Eureka valleys, and radioactive and toxic chemical emissions from the nearby University of California—San Francisco Medical Center. The wind patterns in the area argue against the emissions as the culprit, however.

In both April and December 1988, at the request of Sutro Tower Inc., engineers from Hammett & Edison, a San Francisco-based consulting firm, measured RF radiation levels near the tower and in the Noe and Eureka valleys. Typical values in publicly accessible areas close to the tower were in the 3-10 $\mu\text{W}/\text{cm}^2$ range—the highest reading was 530 $\mu\text{W}/\text{cm}^2$ in a small area near a lamppost. (Similar readings were found in a 1985 survey.) In the Noe and Eureka valleys, typical readings were 0.5 $\mu\text{W}/\text{cm}^2$, with a maximum of 2.6 $\mu\text{W}/\text{cm}^2$.

HIGHLIGHTS

William Hammett, who took the December 1988 measurements, told *Microwave News* that the city of San Francisco had recently run its own RF survey and had obtained similar readings.

The city Department of Public Health said that it will continue to monitor the rates of childhood cancer.

FCC Proposes Revising EMI Measurements for Computers

The Federal Communications Commission (FCC) has proposed revising its rules for measuring electromagnetic emissions from digital devices such as computers. The revised rules, *FCC Procedure for Measuring Electromagnetic Emissions from Digital Devices, FCCIOET TP-5*, known simply as *TP-5*, will replace the existing measurement rules, *MP-4*, adopted in 1983 (see *MWN*, S83).

Under the *TP-5* proposal, different procedures are specified for measurements of conducted and radiated emissions from tabletop devices and from floor-standing and other large digital devices.

The proposed changes were prompted in part by a 1987 petition from the Computer Business and Equipment Manufacturers Association (see *MWN*, M/J87 and S/O87). The FCC also notes the fact that the "computer industry has changed dramatically since 1980 in ways that affect how computers are tested." The notice of proposed rulemaking was released on March 7.

EPA Measures RF Radiation in McFarland, CA

A preliminary analysis of measurements taken by a team from the Environmental Protection Agency (EPA) indicates that the primary source of ambient radiofrequency radiation in McFarland, CA, is UHF television signals, with a smaller contribution coming from the Voice of America (VOA) station in nearby Delano. The levels were in the nanowatt per square centimeter range.

Norbert Hankin and Ed Mantiply, both of EPA's Office of Radiation Programs, took extensive measurements in McFarland and in and around the Delano VOA station March 6-16, with the assistance of staffers from the VOA and from the National Telecommunications and Information Administration. A report is in preparation and should be available by late summer.

The EPA measurements were made at the request of the California Department of Health Services as part of its continuing effort to identify the cause of a cancer cluster among the children of McFarland (see *MWN*, J/F88 and S/O88).

Recent FCC tests of digital devices found that a "significant percentage" of the equipment did not comply with the commission's RF emission limits. The FCC hopes that by providing additional guidance and clarification, the compliance rate will improve and that the new procedures will facilitate more efficient testing and reduced compliance costs.

Some people have argued that the FCC should go further and adopt the recommendations in *CISPR Publication 22* for controlling interference; a number of European countries have already done so. The FCC is requesting comments as to whether its emission limits and test procedures should conform to those of CISPR.

Comments are due by May 8 and reply comments by June 7. Contact: Hugh Van Tuyl or Richard Fabina, FCC Lab, 7435 Oakland Mills Rd., Columbia, MD 21046, (301) 725-1585.

U.S.S.R. Meetings on ELF, MWs and MM Waves

U.S. scientists have been invited to attend an international symposium on *The Fundamental Aspects of the Application of Millimeter-Range Electromagnetic Radiation in Medicine*, to be held in Kiev, U.S.S.R., May 10-13. The meeting is being organized by Professor S.P. Sitko; papers will be presented in Russian, Ukrainian and English.

"This is the first time they have opened up this type of meeting to Americans," Dr. Om Gandhi of the University of Utah in Salt Lake City told *Microwave News*. He noted that, while work in this area has virtually ceased in the U.S., the Soviets are continuing their studies. "They continue to believe in frequency-specific effects of millimeter waves," he said.

Neither Gandhi nor Dr. Shirley Motzkin of the Polytechnic University in Brooklyn, NY, both of whom were invited to the Kiev meeting, has yet been able to secure travel funds. Without travel grants, both said that they will be unable to attend.

And next September 25-30, Soviet and U.S. scientists will meet in Uzhgorod in the Soviet Ukraine as part of a continuing U.S.-U.S.S.R. cooperation program. Workshops are held every two years (see *MWN*, M85 and J/A87).

According to Jack Monahan of the Center for Devices and Radiological Health at the Food and Drug Administration in Rockville, MD, the workshop will focus on biological effects at extremely low and microwave frequencies. Last year, Monahan took over as the U.S. coordinator of the U.S.-U.S.S.R. program from Dr. Don McRee, whose agency—the National Institute of Environmental Health Sciences—stopped sponsoring its own non-ionizing radiation research (see *MWN*, J/A87).

In addition to Monahan, those invited to attend the Uzhgorod workshop are: Drs. Larry Anderson, Carl Blackman, Reba Goodman, Bill Guy, Imre Gyuk, Henry Kues, Henry Lai, Mary Ellen O'Connor and Howard Wachtel.

« Power Line Talk »

The controversy continues over a power line built by the Irish Electricity Supply Board in County Wicklow. In January, the line was energized after the Minister for Energy, Michael Smith, received a report prepared by his chief technical advisor, Dr. Tom McManus, who found "no health risk on the basis of present knowledge." *Electromagnetic Fields from High Voltage Transmission Lines* concludes that, "There is no scientific basis at this time to justify a further delay to the energizing of the Carrickmines-Arklow 220 kV transmission line." The 35-mile power line, which reportedly cost £9.5 million (IR), is located near two schools (and many homes)—it replaces an existing 110 kV line along the same right-of-way. The November 1988 report notes that the calculated maximum magnetic fields near the two schools are approximately 20 and 40 mG; the calculated maximum electric field levels are less than 4 kV/m. Smith called for an independent assessment following protests from concerned county residents and a citizens' group called SPARKS—Stop Powerlines Across Residences, Kindergartens, and Schools (see *MWN*, S/O87). SPARKS's John Royds called the report a "whitewash" and in a letter to the *Irish Times* (February 7) rejected it because "it contains flaws, omissions and is biased." Royds questioned how the report can be "independent" when it was written by the minister's own advisor. SPARKS is preparing a detailed response to the report and, in the meantime, is fighting for the line to be "switched off during school hours as an interim measure." Copies of the report are available for £12 (IR), including shipping and handling, from: Government Publications Sales Office, Sun Alliance House, Molesworth Street, Dublin 2, Republic of Ireland. The check must be in Irish currency.

«« »»

The deadline for responses to the National Cancer Institute's (NCI) requests for proposals (RFPs) for its study of the etiology of childhood cancer and EMFs has been extended. Proposals are now due by April 6. Meanwhile, the investigation into the possible ethical violations by NCI staffers testifying at power line hearings and trials continues.

«« »»

Through the years a number of people have speculated over a possible association between sudden infant death syndrome (SIDS) and EMF exposure. Recently, the *Sunday Mirror*, a British tabloid, has turned the issue into a crusade featuring a series of articles on "cot death" and its link to power lines, radar and microwaves. The headlines have been sensationalistic: for instance, "Rays of Death: Electro Waves Clue to Cot Tragedy Babies" and "Meter Goes Haywire in New Tests." Roger Coghill and Dr. Cornelia O'Leary, both of Coghill Research Associates, a London-based consulting firm specializing in EM pollution, started the frenzy in January with seminars on "Electropollution: The Hidden Threat to the Planet."

The *Sunday Mirror* reported that research has been ignored because the medical world is "too frightened of its implications." On January 29, the tabloid's reporter Paul Scott and Coghill blamed "a cluster of anguish" on radar radiation from the Farnborough Air Force Base. In a February 12 follow-up, Scott quotes Coghill: "The poor babies were bombarded with incredibly powerful electromagnetic waves. They didn't have a chance." The *Mirror's* editors, believing they were on to something important, sent Scott and Coghill 6,000 miles to Rohnert Park (near Santa Rosa), CA, where there has been another cluster of SIDS cases. In a March 12 item, Scott dubbed the area "the electromagnetic capital of the world," and reported that, "Once again we have discovered important evidence that the babies were killed when they were exposed to dangerously high levels of magnetic waves." On February 19, the *Sunday Mirror* also reported that Lord Laurence Olivier had called in Coghill to test the bedroom of his eight-month-old grandson for electromagnetic waves. After being given the "all clear sign" by Coghill, Olivier said, "We must make sure that people like Mr. Coghill are given enough money to carry out this important work." According to the *Sunday Mirror*, Olivier is planning to come out of retirement to narrate a television series about the "harmful effects of the waves."

«« »»

Planners have joined the ranks of those concerned about potential EMF health effects. Joel Goldsteen, a city and regional planner at the University of Texas in Arlington, wants other planners to be aware of the potential public health hazard posed by power line EMFs. In the January 1989 issue of *Planning*, the journal of the American Planning Association, Goldsteen concludes—after plotting the paths of power lines in the Dallas-Fort Worth metropolitan area and taking into account statistics from recent research showing increased cancer risk among people living within 500 feet of high-voltage lines—that "some seven percent of the area's residents could at some point be negatively affected by the EMFs of overhead power lines." Goldsteen notes that some planners have promoted the idea of using power line rights-of-way as "parklike 'amenities.'" He suggests that, in the future, planners may have to employ environmental risk assessment methods, such as considering epidemiological studies on EMF-cancer risks, when siting new schools.

«« »»

On March 13, the entire Hydro-Québec power grid went down, knocking out electrical service to almost six million people and the Montréal subway system, according to the Associated Press. The power failure, which reportedly was triggered by a magnetic storm from a solar flare, was the third "province-wide" power failure this year. Some people blame the system's vulnerability on Hydro-Québec's large power sales to the northeast U.S.

Swedish Academy of Sciences To Review ELF Effects

The Royal Swedish Academy of Sciences has invited a group of international experts to Stockholm, May 25-27, to review the biological effects of extremely low frequency (ELF) fields. The objectives of the workshop are "to critically scrutinize possible mechanisms and to try to evaluate the significance of experimental findings," according to the academy.

Scheduled speakers at the meeting on *Interaction Mechanisms of Low-Level Electromagnetic Fields in Living Systems—Resonant Phenomena* include Drs. Ross Adey of the Veterans Administration in Loma Linda, CA, P. Bayley of the National Institute for Medical Research in London, U.K., Carl Blackman of the U.S. Environmental Protection Agency in Research Triangle Park, NC, Alessandro Chiabrera of the University of Genoa in Italy, Michel Coleman of the International Agency for Research on Cancer in Lyons, France, Carl Durney of the University of Utah in Salt Lake City, Reba Goodman of Columbia University in New York City, Yngve Hamnerius of the Chalmers University of Technology in Gothenburg, Sweden, Abraham Liboff of Oakland University in Rochester, MI, Robert Liburdy of the Lawrence Livermore Labs in Berkeley, CA, Herman Schwan of the University of Pennsylvania in Philadelphia and Bruno Zimm of the University of California at San Diego.

The meeting, which is by invitation only, will be chaired by Professor Claes Ramel of the academy's environmental committee. For more information, contact: Dr. Hans Lundberg, Environmental Secretary, Royal Swedish Academy of Sciences, PO Box 50005, S-104 05, Stockholm, Sweden, (46) 8-150430.

EPRI R&D Budget for EMFs: \$21.9 Million for 1989-1991

The Electric Power Research Institute (EPRI) has increased its budget for research and development (R&D) on electromagnetic fields (EMFs) to \$21.9 million for 1989-1991. EPRI has allocated \$7.1 million for 1989, \$7.6 million for 1990 and \$7.2 million for 1991.

The institute's EMF budget is now more than twice the Department of Energy's (DOE) \$3.0 million EMF bioeffects research budget for fiscal year 1989 (see *MWN*, S/O88). EPRI and the DOE are the primary sources of EMF research funds in the U.S.

Last year, EPRI predicted it would spend only \$6.0 million in 1989 and 1990; the new budget represents an almost 20% increase (see *MWN*, M/A88). Of the \$21.9 million, \$16.4 million is for EPRI's Environment Division and \$5.5 million

is for its Electrical Systems Division.

The \$21.9 million does not include funds for staff and support, according to EPRI's Dr. Stan Sussman. EPRI's total R&D budget for 1989-1991 is \$865 million.

These statistics appear in *EPRI Research and Development Program 1989-1991*, which is available free to EPRI members, for \$50 for others in the U.S. and for \$70 outside the U.S. from: Susan Rapone, EPRI, PO Box 10412, Palo Alto, CA 94303, (415) 934-4212.

Review Finds "Consistency" to Cancer Risk in Epi Studies

There is a certain consistency to the observed link between exposures to electromagnetic fields (EMFs) and cancer in both residential and occupational epidemiological studies, according to Dr. Anders Ahlbom of the Swedish Institute of Environmental Medicine in Stockholm. The data "strongly suggest" the need for further research, he concludes.

Writing in the *Scandinavian Journal of Work and Environmental Health* (14, pp.337-343, 1988), Ahlbom presents the most detailed review to date of the nine published residential EMF epidemiological studies and finds that, "Given the different study designs, time periods and locales, the findings of the studies do appear to be rather consistent."

With respect to the ongoing debate on the use of wire codes to estimate residential EMF exposures, Ahlbom writes, "As long as the wire coding system is applied in the same way to cases and non-cases, any exposure misclassification can only mask a true effect; it cannot give rise to a spurious effect."

The results of the adult residential studies, when combined, do not provide much evidence for an association, he notes, but he adds that the residential studies "should be considered in tandem with the studies on occupational exposure, and when their results are combined, indeed, an association cannot be disproved."

Ahlbom takes a briefer look at the occupational studies, noting that the literature in this area has been reviewed "thoroughly by others." He concludes that, "Despite the obvious limitations of these studies and the somewhat erratic findings, it is difficult to avoid the conclusions that there is a certain consistency between the results and that it seems likely that these occupations are in fact at an increased risk of leukemia."

He cautions, however, that, based on current data, no conclusion can be drawn about the role of EMFs in the origin of cancer.

Ahlbom was a member of the advisory panel to the New York State Power Lines Project (see *MWN*, J/A87) and is himself directing an ongoing major epidemiological study on power line cancer risks in Sweden (see *MWN*, M/J87).

The contractors and their topics are: Dr. John Peters of the University of Southern California School of Medicine on epidemiological studies; Dr. Asher Sheppard of the VA Hospital in Loma Linda, CA, on lab data and biophysical models; Dr. Kurt Salzinger of the Polytechnic University in Brooklyn, NY, on behavioral effects; Dr. Kenneth Groh of the Argonne National Lab on circadian rhythms; Dr. Neil Chernoff of the Environmental Protection Agency on reproductive and developmental effects; Dr. William Feero of Electric Research and Management on exposure assessments; and Drs. Lee Rosen and William Wisecup of W/L Associates on programs and funding efforts worldwide. W/L Associates will also cover those research areas not addressed by the other reports.

In its report, the PUC will summarize the information supplied by the contractors and make recommendations with regard to future studies and the potential need for exposure guidelines, Murley said. The contractors' reports will be appended to the PUC report. In addition, the PUC has invited the Electric Power Research Institute to submit a report on its own research; it also will be appended to the PUC report.

This summer, the PUC will hold public meetings in San Francisco, Los Angeles and Sacramento, Murley said, adding that additional meetings may be scheduled if the need arises.

Planning is also underway as to which projects will be funded by the \$2 million allocated for research on biological effects of power line fields.

Maryland: Experimental Research

The Department of Natural Resources is considering sponsoring laboratory research on power line EMFs, according to Thomas Magette of the department's Power Plant and Environmental Review Division in Annapolis. Magette, who is serving as the project manager, told *Microwave News* that the agency is "entertaining several proposals" for experiments using 60 Hz magnetic fields, but no decisions have yet been made.

The project, which is tentatively set to begin in the late summer or the early fall, is envisioned as a one-year study, but it may become an ongoing effort.

Virginia: Annual Report Issued

The Virginia Department of Health recently released its fourth annual report on power lines, which concludes that "recently published literature does not perspicuously demonstrate that exposure to electric and/or magnetic fields in the magnitude produced by high voltage transmission lines is causally associated with cancer or any other long-term detrimental effects in humans."

The 12-page report, *Monitoring of Ongoing Research on the Health Effects of High Voltage Transmission Lines*, prepared by the department's Dr. Khizar Wasti, presents an overview of relevant literature published in 1987-88, including, among others, Dr. David Savitz's childhood cancer study, Dr.

NY DOH on Electric Blankets

On February 9, the Fox Network's *Ten O'Clock News* ran a story on the potential risks of magnetic fields from electric blankets. The segment, which featured Dr. David Carpenter of the New York State Department of Health (DOH), referred people to the DOH for more information. The next day, according to Fox reporter Dr. Joanna Shaw, the DOH received over 350 telephone calls—prompting a followup story on Fox's February 10 broadcast. The following is an excerpt from a question-and-answer fact sheet which the DOH sent out to callers.

- Q. Do electric blankets, or waterbed heaters, cause cancer?
 A. No one knows for sure. Electric blankets, waterbed heaters and other electric appliances in the home give off magnetic fields. There have been some scientific studies which suggest—but do not prove—a link between some cancer and the magnetic fields coming from power lines. Some scientists suspect that home appliances could be hazardous in the same way.
- Q. Do electric blankets produce large magnetic fields?
 A. Yes. The magnetic field experienced by the human body under an electric blanket is approximately four times larger than that measured in the homes where higher cancer rates were associated with power lines in the street.
- Q. Do blankets constantly expose people to magnetic fields?
 A. No. The fields are only generated when appliances are turned on. Also, the strength of the field falls off rapidly with distance away from the appliances. Electric blankets, mattress pads and waterbed heaters create a lot of exposure because people often stay in close contact with them for a long time (all night).
- Q. Should I stop using electric blankets? Waterbeds? Mattress pads?
 A. Some people have done that. Others have not. That is a choice for individuals and families to make. The [DOH] is not making any official recommendations. People have to weigh the possible risks, the alternatives available, and any other factors which may be important to them. You may wish to use your electric blanket to warm your bed and then turn it off before getting in.
- Q. What about the risk to pregnant women?
 A. Developing fetuses are more susceptible to many environmental risks than are other persons. Women may wish to consider reducing their exposure to magnetic fields during pregnancy.

Margaret Speers's occupational study of electrical workers and the World Health Organization's report on magnetic fields.

The reports are submitted annually to the Virginia General Assembly by order of state Senate Joint Resolution No. 126, which was approved in 1985 (see *MWN*, J/F86). For more information, contact: Dr. Khizar Wasti, Bureau of Toxic Substances Information, Virginia State Health Department, 109 Governor St., Richmond, VA 23219, (804) 786-1763.

Power Line Actions Across the U.S.

All over the U.S., states are taking action to learn about the potential health effects of electromagnetic fields (EMFs) from power lines. At a time when Florida has adopted power line magnetic fields standards (see p.1), some state legislatures and agencies are simply asking for literature reviews. Others, such as California and Maryland, are being more ambitious and are funding their own laboratory studies. Below is a roundup of the latest actions from across the country.

Oregon: Strict EMF Limits Proposed

The Oregon Department of Human Resources (DHS) will have to adopt interim magnetic and electric field standards of 2 mG and 1 kV/m, respectively, for high-voltage power lines by December 1, 1989, if House Bill No.2932 is passed by the state legislature. Oregon currently has only an electric field standard of 9 kV/m.

The proposed magnetic field limit is the strictest ever proposed in the U.S.—it was adapted from a similar bill introduced in the Washington state senate earlier this year. The Washington bill has since been completely rewritten and all mention of EMF standards has been dropped (see below).

The Oregon House bill was introduced on February 23; a public hearing was scheduled for March 27. The bill is sponsored by Representative Nancy Peterson.

Among the bill's other requirements are that the DHS would evaluate the impact of EMFs on workers and on the environment and report back to the legislature by June 1990. The department would set up a panel to determine whether EMF exposures present an "unreasonable cancer risk." The panel would then submit a report describing the health risks associated with residential EMF exposures and listing high-priority research projects needed to better understand them.

At the same time that the state legislature is weighing action, the state Department of Energy is conducting its own EMF research review. David Stewart-Smith of the department's Nuclear Safety and Energy Facilities Division told *Microwave News* that he has put together a five-member panel to evaluate existing literature reviews. The panel will pass its findings on to the Energy Facilities Siting Council, an independent state agency which has the authority to set standards. Stewart-Smith said that the budget for the review is approximately \$10,000-12,000.

Washington: Literature Review Sought

Senate Bill No.5275 would require a literature review of ongoing studies on EMF effects by the Washington State Institute for Public Policy, with the assistance of the Oregon Department of Energy. The bill, which would appropriate \$10,000 for the review, calls for the institute to issue a report to the senate Committee on Energy and Utilities by December

1, 1989.

The senate approved the bill on March 8; it awaits action by the state assembly.

In its original form, the bill, which was sponsored by Senators Eleanor Lee and Phil Talmadge, sought the adoption of interim standards for power line EMFs as well as a study by a state epidemiologist of the impact of EMFs on workers and on the environment (see *MWN*, M/J88).

New York: Reducing EMFs

New York state utilities will soon complete plans for surveying EMFs around power lines and for developing ways of reducing the magnetic fields. The effort, which is being coordinated through the New York City-based Empire State Electric Energy Research Corp. (ESEERCO), is required by an April 1988 order from the NY Public Service Commission (PSC). It follows the recommendations of the PSC's EMF task force report, which in turn was prompted by the final report of the NY Power Lines Project (see *MWN*, M/A88).

The first phase of the project will be to characterize magnetic fields and then examine ways to reduce them. The next step will be to initiate projects to remedy problems identified in the first stage.

The survey data on 345 kV power line magnetic fields will be submitted to the PSC and will then be fed into a computer database. A technical conference, which was also ordered by the PSC last year, will be held this summer. The meeting will be open to the public, according to the PSC's Dan Driscoll.

Plan for Surveying Electric and Magnetic Fields from Overhead and Underground Power Lines in New York State and Research Plan on Reducing Magnetic Fields Associated with Power Delivery and Use will be published as one document and should be available by the end of April, ESEERCO's Herb Kaufman told *Microwave News*.

California: PUC Report Delayed

The Public Utilities Commission's (PUC) report on power line EMF effects, originally due on March 15, will now be submitted to the state legislature by September 15. Last year the legislature instructed the PUC and the state Department of Health Services to submit reports on "cancer and other medical risks which may be related to exposure to [EMFs] produced by electrical utility facilities" (see *MWN*, M/J88, S/O88 and N/D88).

Over the past six months, the PUC has hired seven contractors to submit eight reports on power line EMFs. The reports are costing the PUC \$56,000. The money comes from the PUC's own budget, rather than from the \$2 million allocated by the legislature for health research, the PUC's Clyde Murley told *Microwave News*.

HVDC Power Line and Agriculture Study: No Effects

There is "no evidence that a ± 500 kV DC transmission line caused any effects on cattle or crops that would impact commercial farming or ranching operations," according to a new study sponsored by the Bonneville Power Administration (BPA) in Oregon.

While acknowledging that no single study can resolve all the questions about potential high voltage (HV) power line biological effects, the recently-released *Joint HVDC Agricultural Study* concludes that the results, taken with existing research, indicate that "it is unlikely that HVDC transmission lines cause adverse effects on plants, animals or people."

In one part of the Oregon project, 100 cows and six bulls were confined in pens directly under the line; the same number were kept in similar pens away from the line. No significant differences were observed in body weight, number of calves born or behavior—except that 1-4% fewer exposed

cattle remained in areas directly under the line than in the corresponding areas in the control pens. The reason for this was not determined.

The three-year \$1.7 million study at the Pacific Intertie power line was run by a team led by Robert Raleigh of Oregon State University in conjunction with the BPA, with assistance from the Electric Power Research Institute and from the Department of Energy. In addition, nine other utilities from around the country supported the project "because of renewed interest in the use of DC lines."

For more information, contact: Jack Lee, Project Coordinator, BPA, PO Box 3621-EFBG, Portland, OR 97208.

Also, Professors James Hornig and John Walsh, both at Dartmouth College in Hanover, NH, are working on a three-year, \$400,000 project to study electric and magnetic fields and ion concentrations surrounding a new ± 465 kV DC line which runs from Canada to Massachusetts. The state of New Hampshire is sponsoring the project. Hornig, a chemist, and Walsh, a physicist, will monitor the line for one year before and two years after the line is energized.

ELF and Power Line Resources

J.H. Bernhardt, "The Establishment of Frequency Dependent Limits for Electric and Magnetic Fields and Evaluation of Indirect Effects," *Radiation and Environmental Biophysics*, 27, pp.1-27, 1988.

The author, who is with the Institute for Radiation Hygiene in Neuherberg, F.R.G., and a member of IRPA's non-ionizing radiation committee, outlines a biophysical model—the basis for certain German standards—for determining EMF exposure limits for 50/60 Hz and higher frequencies. Direct and indirect EMF bioeffects are also discussed.

J.E. Deadman et al., "Occupational and Residential 60-Hz Electromagnetic Fields and High-Frequency Electric Transients: Exposure Assessment Using a New Dosimeter," *American Industrial Hygiene Association Journal*, 49, pp.409-419, August 1988.

Using the lightweight dosimeter developed by Hydro-Québec's IREQ (see *MWN*, S/O86), this team from McGill University and from Hydro-Québec measured significantly higher electric and magnetic field and high-frequency transient electric (HFTE) field exposures for utility workers than for those exposed to normal background fields—by a factor of ten for electric and magnetic fields and by a factor of 171 for HFTE fields. When weekly averages—combining work and non-work exposures—were compared, the differences were still significant, though smaller, for magnetic fields (a factor of 3.5) and for HFTE fields (a factor of 58).

William Feero, John Dunlap and James Yontz, "Magnetic Fields Remote from Substations," presented at the *Winter Meeting of the IEEE Power Engineering Society (PES)*, January 29–February 3, 1989 in New York City. A copy is available for \$3.50 (members) and \$6.50 (nonmembers) from: Single Publication Sales Dept., IEEE Service Center, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855. Cite

No.89WM096-9PWRD.

This study was prompted by public fears of health risks when Florida Power and Light Co. announced plans to build a new substation. The researchers found that the EMFs associated with substations decay quickly with distance—no fields could be detected 250 feet from the substation studied. Twenty feet from the fences of three similar 23 to 230 kV substations, the magnetic fields were less than 20 mG, often less than 10 mG, with the exception of transmission line entry and exit points.

Lita Furby et al., "Public Perceptions of Electric Power Transmission Lines," *Journal of Environmental Psychology*, 8, pp.19-43, 1988; and "Electric Power Transmission Lines, Property Values and Compensation," *Journal of Environmental Management*, 27, pp.69-83, 1988.

In the first article, the authors review and critique the literature on attitudes towards power lines, including such issues as health effects, property values and aesthetics. In the second, they concern themselves with current methods of determining the impact of power lines on land values and appropriate compensations to landowners for associated losses. The authors include Paul Slovic and Baruch Fischhoff, who are well-known for their studies on risk analysis.

N. Hayashi, K. Isaka and Y. Yokoi, "Analysis of Magnetic Field Profiles in Electric Blanket Users," presented at the *IEEE Power Engineering Society (PES) Winter Meeting*, January 29–February 3, 1989 in New York City. (See Feero et al. at left for ordering information; cite No.89WM100-9PWRD.)

Professor Isaka and coworkers at the University of Tokushima in Japan present calculations of magnetic fields from electric blankets, which agree reasonably well with measured values. Among their conclusions are that, "The separation between the body surface and

the blanket heating element is the most influential parameter on the magnetic field exposure," and that the maximum fields on the user's body surface range from 5 to 50 μ T, depending on which component is measured.

Jukka Juutilainen et al., *Measurements of 50 Hz Magnetic Fields in Finnish Homes*, Helsinki, Finland: Imatran Voima Oy, 31 pp., 1989.

Juutilainen and coworkers at the University of Kuopio report that ELF magnetic fields from T&D lines "can increase the long-term average field levels in residences," but they warn that the increase was "found only in the immediate vicinity of external sources." Magnetic fields from appliances were "slightly lower," though "of the same order of magnitude," as reported in U.S. surveys—perhaps due to the different distribution voltages. They also found that higher magnetic fields were measured in rooms with electric underfloor heating.

Daniel Lyle et al., "Suppression of T-Lymphocyte Cytotoxicity Following Exposure to 60-Hz Sinusoidal Electric Fields," *Bioelectromagnetics*, 9, pp.303-313, 1988.

Lyle and coworkers at Dr. Ross Adey's lab in Loma Linda, CA, found a significant inhibition of cytotoxicity in T-lymphocytes following exposure to 10 mV/cm and 1.0 mV/cm electric fields and a non-significant inhibition at 0.1 mV/cm. These findings indicate a dose-response relationship and a threshold for the effect, and also point to a potential mechanism by which electric fields affect the function of the immune system.

Carl Maresh et al., "Exercise Testing in the Evaluation of Human Responses to Powerline Frequency Fields," *Aviation, Space and Environmental Medicine*, 59, pp.1139-1145, December 1988.

Eleven men in their 20s exposed to 60 Hz (9 kV/m, 16 A/m) fields for two hours had slower heart rates if they did not exercise first—there was no difference between exposed and controls if the exposure followed 45 minutes of exercise. The researchers are at the University of Connecticut and at the Midwest Research Institute (MRI). They include MRI's Harvey Cohen and Dr. Charles Graham.

Granger Morgan et al., *Electric and Magnetic Fields from 60 Hertz Electric Power: What Do We Know About Possible Health Risks?* Pittsburgh, PA: Carnegie Mellon University (CMU), 45 pp., 1989. Copies are available (prepaid) for \$3.00 each for the first nine, \$2.00 each for ten or more, from: Dept. of Engineering and Public Policy, CMU, Pittsburgh, PA 15213.

This brochure, written by Morgan's research group at CMU, is designed for the layperson. Using a question and answer format, it includes what is and is not known about health effects, especially cancer, and concepts of risk assessment; there is also a glossary.

Keith Petrie et al., "Effect of Melatonin on Jet Lag After Long Haul Flights," *British Medical Journal*, 298, pp.705-707, March 18, 1989.

After flying back and forth through 12 time zones over a period of three weeks, a group taking melatonin reported being less tired

during the day and requiring less time to establish normal sleeping patterns than the control group. The researchers concluded that "melatonin can alleviate jet lag and tiredness after long haul flights."

Russel Reiter et al., "Reduction of the Nocturnal Rise in Pineal Melatonin Levels in Rats Exposed to 60-Hz Electric Fields in Utero and for 23 Days After Birth," *Life Sciences*, 42, pp.2203-2206, 1988.

Working with the Battelle team, Reiter found that rats exposed to electric fields of 10, 65 or 130 kV/m from conception to 23 days of age showed reduced peak nighttime pineal melatonin levels and shifts in circadian rhythms. No dose-response relationship was observed, however.

Martin Rosenthal and Günter Obe, "Effects of 50-Hertz Electromagnetic Fields on Proliferation and on Chromosomal Alterations in Human Peripheral Lymphocytes [HPLs] Untreated or Pretreated with Chemical Mutagens," *Mutation Research*, 210, pp.329-335, 1989.

Cultured HPLs exposed to 50 Hz 5 mT fields showed significant stimulation of the cell cycle progression, but no change in the frequency of sister-chromatid exchanges (SCEs) or chromosomal aberrations. In some cases, exposing HPLs pretreated with alkylating agents led to significantly higher frequencies of (SCEs). However, the authors reject the latter finding pending further studies.

O.C. SeEVERS, *Ground Currents and the Myth of Stray Voltage*, Lilburn, GA: The Fairmount Press, Inc., 211 pp., 1988, \$44.00.

The author, a utility engineer for nearly 40 years who has a chatty writing style, presents detailed electrical calculations as well as data from actual court cases involving stray voltage and ground currents. The publisher entices readers with the following incentive: "How understanding stray voltage can help you avoid costly lawsuits."

Mike Silva et al., "Power Frequency Magnetic Fields in the Home," *IEEE Transactions on Power Delivery*, 4, pp.465-478, January 1989.

Describes extensive measurements of residential magnetic fields from external and internal (e.g., appliances) sources. One interesting finding: certain two-way switch wiring configurations for overhead lighting—producing a large overhead coil—generated magnetic fields up to ten times the typical mean values. The work was supported by EPRI.

Richard Wurtman and Judith Wurtman, "Carbohydrates and Depression," *Scientific American*, 260, pp.68-75, January 1989.

The Wurtmans address mood and appetite disorders, including seasonal affective disorder (SAD) and, along the way, review the roles of serotonin and melatonin.

Xiao-lin Xi and Granger Morgan, "Energizing China: First Itself, Next the World," *IEEE Spectrum*, pp.59-63, March 1989.

An overview of the electric power industry in the People's Republic of China today.

UPDATES

BIOLOGICAL EFFECTS

More Harm Than Good... Miniature radio transmitters which are strapped onto spotted owls to track their movements may be harming, rather than helping, the birds. According to a February 20 report by the Associated Press (AP), 37 out of 48 owls fitted with the transmitters, which weigh approximately 20 grams, died in the first year of study. Some experts contend that the spotted owls, which live in the north-west U.S., are an endangered species. Although one Fish and Wildlife Service biologist attributes the deaths to "predations and starvation," another points out that the devices have been shown to affect other birds, though there is no evidence of a similar effect on spotted owls, the AP reports. Both experts recommend further study.

COMPATIBILITY & INTERFERENCE

Assessing EEDs... Two staffers at the NIST (NBS) in Boulder, CO, have come up with a new method for characterizing the response of electro-explosive devices (EEDs) to pulsed EMFs: using a combination of statistics and thermodynamics to determine the probability that an EED will be detonated when excited by a pulse of a given width and amplitude. John Adams and Dennis Friday, whose study appeared in the November 1988 *IEEE Transactions on Electromagnetic Compatibility*, claim that their approach is both "more general and more efficient than previous methods used for EED assessment."

GOVERNMENT

Q's & A's on RF Bioeffects... The FCC has issued the third edition of *Questions and Answers about Biological Effects and Potential Hazards of RF Radiation*, OET Bulletin No. 56. The 18-page report provides answers to some basic questions, such as: What is RF radiation? How is it used? How is it measured? What are its biological effects? What are safe exposure levels? Also addressed are specific RF sources: TV and radio broadcast towers, MW point-to-point relays, cellular and cordless phones and satcom stations. The bulletin is available from: National Technical Information Service, Springfield, VA 22161, (800) 336-4700 for \$13.95. Order No. PB89-165286.

Committee Openings... The FDA is seeking nominations to fill five vacancies on its Technical Electronic Product Radiation Safety Standards Committee (TEPRSSC) at the end of 1989. The TEPRSSC addresses devices which emit either ionizing or non-ionizing radiation. The openings are for two members from the general public, two members from government (federal or state) agencies and one member from "affected industry." Applicants must have scientific or engineering training or equivalent experience. Send nominations to: Arlene Underdonk, Office of Standards and Regulations (HFZ-83), CDRH, 5600 Fishers Lane, Rockville, MD 20857.

MEASUREMENT

Briefs... Robert Clarke gives some pointers on "Picking an EMI Test Lab" in the January 1989 issue of *Test & Measurement World*. He advises some caution: "Choose your EMI lab with the same care that you would use in choosing a doctor." The article includes a survey of the leading labs with a listing of the services offered by each....The NIST (NBS) has signed an agreement with the Standards Council of Canada (SCC) that provides for mutual recognition of testing labs accredited by the NIST's NVLAP program and by the SCC's National Accreditation Program for Testing Organizations. The agreement is in accordance with the U.S.-Canada free trade pact, which went into effect on January 1, 1989. The pact with Canada follows similar arrangements with the U.K., Australia and New Zealand....Holaday Industries has released a new 18-page catalogue of its RF/MW meters and its instruments that measure EMFs from VDTs and power lines. Contact: Holaday Industries, Inc., 14825 Martin Dr., Eden Prairie, MN 55344, (612) 934-4920....Electro-Metrics has introduced a new portable hand-held EMI test receiver, the EMC-P80, for measurements in the 2-34 MHz band. The unit, which costs \$4,995, is ideal for tracking down radiated interference sources. The company is also now marketing a receiver for TEMPEST testing in the 20 Hz to 50 kHz frequency range. The TTR-51L costs \$19,950. Contact: Electro-Metrics Marketing Dept., 100 Church St., Amsterdam, NY 12010, (518) 843-2600.

New from the NIST... The NIST has issued two new reports. *Generation of Standard Electromagnetic Fields in a TEM Cell*, Technical Note 1319, by Dr. Motohisa Kanda and David Orr, details the pros and cons of the TEM—transverse electromagnetic—cell, which was developed at the NIST. It includes copies of some key papers on the use of TEM cells published over the last few years. A copy is available for \$12.00, prepaid, from: Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Order No. 003-003-02898-3....NIST's Electromagnetic Technology Division has a prolific staff. Mary DeWeese has compiled *Metrology for Electromagnetic Technology: A Bibliography of NBS Publications*, NBSIR 88-3097, which lists its publications (1970-1988) on optical electronics, cryoelectronics and superconductivity. It is a companion to an earlier volume listing publications of NIST's Electromagnetic Fields Division (see *MWN*, J/A86). The new bibliography is available for \$15.95, prepaid, from: National Technical Information Service, Springfield, VA 22161. Order No. PB88-123682.

MEDICAL APPLICATIONS

AMA on PEMF Stimulation... A majority of a panel of experts assembled by the American Medical Association (AMA) has deemed that PEMF stimulation for the treatment of nonunion fractures is safe, but also that it has not yet been

UPDATES

shown to be effective. In a "Diagnostic and Therapeutic Technology Assessment" published in the February 10, 1989 issue of the *Journal of the American Medical Association*, the panel concluded that more well-controlled clinical trials are needed to establish efficacy: "Many [panelists] believed that the lack of controlled clinical trials compromised a thorough evaluation of the effectiveness of the treatment." Some promising results on a double-blind study of delayed fractures of the tibia may soon change this assessment. In a paper presented at the *101st Annual Meeting of the American Orthopaedic Association* in Hot Springs, VA, June 20-23, 1988, Dr. William Sharrard, based at Royal Hallamshire Hospital in Sheffield, U.K., reported a statistically significant enhanced union when treated with PEMFs. This finding is in contrast to preliminary results of a double-blind study—published in 1984 by Sharrard and others—indicating that nonunion fractures healed as well by immobilizing them as by treating them with PEMFs (see *MWN*, Ju84).

MEETINGS

Statisticians & EMFs...The *8th Conference on Radiation and Health of the American Statistical Association (ASA)*, July 9-13, will be devoted to "Health Effects of Electric and Magnetic Fields: Statistical Support for Research Strategies." Attendees at the meeting, which will take place in Copper Mountain, CO, will hear from Drs. Dan Bracken, a consultant, Leeka Kheifets of EPRI, Granger Morgan of Carnegie Mellon University, Charles Poole of Epidemiology Resources, Inc., Lee Rosen of W/L Associates, Mays Swicord of the FDA, Thomas Tenforde of Battelle and Gillis Theriault of McGill University, among others. For more information, contact: Marilyn Humm, ASA, 1429 Duke St., Alexandria, VA 22314, (703) 684-1221.

ELF and Power Line Sessions...More and more organizations are putting EMFs on their meeting agendas....The *35th Annual International Education Seminar of the International Right of Way Association*, June 18-22, will feature Harris Levin of Houston Light & Power on EMFs in the courtroom, as well as a question and answer panel on EMFs....At the *5th Annual Symposium of the Electromagnetic Energy Policy Alliance (EEPA)*, April 12-14, a panel of speakers from the EMF community will address the subject of "Electricity: Is There a Risk?" AT&T Bell Labs' Ron Petersen and Dr. Max Weiss will be the session co-chairmen. Also on the EEPA's agenda is a workshop on litigation, legislation and education, featuring Tom Watson of Crowell & Moring, who is involved in many power line cases around the country, and Gary Sazer of Parker, Chapin, Flattau & Klimpl, who is counsel to the Long Island Association, which is seeking to overturn New York's Suffolk County VDT law....At the *13th Annual Meeting of the American Society of Preventive Oncology*, March 20-21, Battelle's Dr. Richard Stevens will speak on electric power and breast cancer risk....And at the *51st Annual Meeting of the American Power Conference*, April 24-26, G.B. Johnson and

B.A. Clairmont, both of General Electric Co., who are at the EPRI High Voltage Transmission Research Center in Lenox, MA, will present a paper on "Measurements of AC and DC Field and Corona Effects in a Hybrid Corridor."

Zurich EMC Meeting...The *8th International Zurich Symposium and Technical Exhibition on EMC* was held March 7-9 in Switzerland. Among the 115 papers presented were a report from Japan on the global distribution of power line harmonic radiation based on satellite data, a report from The Netherlands on methods of protecting electronic equipment against EMI—including testing in high-voltage substations—and a report on a new F.R.G. procedure to establish safe distances between RF sources and electro-explosive devices. For more information, contact: Professor T. Dvorák, EMC Symposium & Exhibit, ETH-Zentrum - IKT, 8092 Zurich, Switzerland, (1) 256-2788.

MW Weapons...The *7th DOD Conference on Directed Energy Weapon Vulnerability, Survivability and Effects* will be held at the U.S. Naval Postgraduate School in Monterey, CA, May 9-12. Dr. T. Wieting of the Naval Research Lab will give an overview of high power microwaves (HPMs); Dr. H. Cabayan of Lawrence Livermore National Lab will discuss the susceptibility of U.S. systems to RF radiation; Howard Bassen of the Walter Reed Army Institute of Research will review the Army program on HPM bioeffects; and a team from Los Alamos National Lab will describe progress on explosion-driven HPM weapons research under the high-intensity single pulse source program. There will be additional presentations at the meeting, which is classified Secret. For more information, contact: Donna Richard, Booz, Allen & Hamilton, Inc., 1300 N. 17th St., Suite 1610, Rosslyn, VA 22209, (703) 527-5429.

MILITARY SYSTEMS

EIS on USAF Transmitter Site...The USAF has announced that it will prepare an environmental impact statement (EIS) for the planned Northeast Regional Communications Facility (NRCF) in the Pine Barrens near Warren Grove, NJ. The decision to prepare the EIS followed pressure from the NJ governor, NJ's Congressional delegation and the state legislature—all oppose building the 18 towers, which would range in height from 100 to 221 feet, in an environmentally sensitive area, according to the February 22 *Philadelphia Inquirer*. In 1985, the USAF also met intense opposition when it proposed building the NRCF in Hawley, MA (see *MWN*, J/A85); it later abandoned its plans for that site. For more information, contact: Richard DiCamillo, HQ USAF/PRPJB, Pentagon Room 5C966, Washington, DC 22030.

OVENS

More on Incomplete Cooking...Experts continue to warn consumers that food cooked in a MW may still harbor parasites and bacteria due to incomplete or uneven heating (see

MWN, Ju81, A82 and S/O88). Tests at the Institute of Food Research in Norwich, U.K., showed that a stuffed chicken treated with bacteria had viable bacteria after MW cooking. In order to prevent bacterial survival, the researchers recommend that food cooked (and reheated) in a MW reach a uniform temperature of 70°C. In a letter published in the January 28 *Lancet*, they advise letting food stand after cooking "to allow the heating to be evenly distributed by conduction without overcooking." ...In a related study appearing in the *Journal of Microwave Power and Electromagnetic Energy* (23, pp.183-194, 1988), Wen Lin and Dr. Carol Sawyer, both of the Department of Food Science and Human Nutrition at Michigan State University in East Lansing, report that wrapping meat loaf in polyvinylidene chloride film prior to MW cooking resulted in the survival of fewer anaerobic bacteria.

Consumers Union Ratings...In the March 1989 issue of *Consumer Reports*, Consumers Union (CU) evaluates over 50 midsize MW ovens for efficiency, price and MW radiation

leakage, among other criteria. According to CU, all of the ovens tested were "well within the U.S. Bureau of Radiological Health's [BRH] standard" for leakage (BRH is now known as the Center for Devices and Radiological Health). CU cautions, however, that any oven that has been damaged—from a fire, from a "serious overheating incident" or from having been dropped—may have a warped or misaligned door, which increases the likelihood of greater leakage. "If there's any doubt about the oven, have it checked by a qualified professional," the group advises. CU also notes the potential hazards associated with MW heat susceptors—metalized films and coatings used in packaging to concentrate heat for browning and crisping—and the FDA's concern that the high temperatures created by the susceptors might cause chemicals in the packaging to "contaminate" food. In addition, plastic wraps, when overheated, can leach chemicals into food. CU suggests that if you use plastic wraps for MW cooking, avoid their direct contact with food and poke holes in the plastic to release steam.

Florida Magnetic Field Standards (continued from p.1)

Tarpon-Kathleen line—are not giving up their fight for protective standards. The county attorney has issued a challenge to the rules, citing, among other issues, concern about potential health risks.

For magnetic fields, the maximum levels are 150 mG for lines of 230 kV or less and 200 mG for 500 kV lines; for certain double-circuit 500 kV lines, the limit is 250 mG (see table below). In contrast, in June 1988, the DER proposed *daily average* and *maximum* magnetic field levels of 50 mG and 100 mG, respectively. "We dropped the daily average standard, because it would be too hard to verify," Owen said.

For electric fields, the new standard is 2.0 kV/m at the edge of the right-of-way (ROW). The earlier proposed limit was 1.5 kV/m.

Under the new regulations, the 500 kV Lake Tarpon-Kathleen power line must comply with limits negotiated by

the state Siting Board and the Florida Power Corporation (FPC) during the line's certification process last spring: the magnetic field limits are a *daily maximum* of 35 mG and 24 mG under normal load conditions where the ROW is 100 feet and 190 feet, respectively. (Under load conditions exceeding 500 MW—allowed no more than 15 hours a year—the *maximum* levels are 229 mG at the 100-foot ROW and 154 mG at the 190-foot ROW.) Since the 500 kV line will only operate at 16% of its capacity, according to Owen, the limits are also based on a "technologically achievable" level.

In a March 22 petition, County Attorney Frederick Karl, representing Hillsborough County, argued that the rules "arbitrarily" separate power lines into three categories—existing lines, new lines and the Lake Tarpon-Kathleen line—and that they contain "substantive and material changes" from the way the rules were originally drafted. Furthermore, Karl charges

Florida's Standards for Maximum 60 Hz Electric and Magnetic Fields

Type of Field	Type of New Power Line			Proposed Levels†
	≤230 kV	500 kV	500 kV (double circuit)*	
Magnetic (edge of ROW)	150 mG	200 mG	250 mG	100 mG
Electric (edge of / on ROW)	2 / 8 kV/m	2 / 10 kV/m	2 / 10 kV/m	1.5 kV/m

* Special exceptions apply.

† The DER proposed these levels in June 1988. A daily average magnetic field limit of 50 mG was also proposed.

that the Environmental Regulation Commission "failed to consider all of the scientific evidence available" in promulgating the rules and that the rules "conflict with the Resolution passed the same day" which cites potential public health risks from power line EMFs (see box below). "Our position is that the standards are not protective of public health," Chief Assistant County Attorney Elliott Dunn told *Microwave News*. Dunn added that the county attorney's office became involved following an appeal from Hillsborough citizens to "keep up the fight" and challenge the rules.

The DER's decision to relax the proposed standards was prompted, in part, by data showing that seven out of ten 500 kV lines operating in the state can meet the 200 mG limit, Oven explained. Last year, Oven told *Microwave News* that the vast majority of the state's existing 500 kV lines did not conform to the proposed 50-100 mG levels, nor did more than half of the existing 230 kV lines (see *MWN*, M/J88). He pointed out that even some of the 138 kV lines could not comply.

The maximum magnetic field level for 230 kV lines, which was also raised to 200 mG, was later reduced to 150 mG

because of complaints from residents that a 200 mG standard would be too lax for smaller lines, Oven said. The 150 mG limit—which was proposed and then adopted at the January 18 hearing—is "basically a compromise" between what the utilities asked for and what the citizens wanted, he said.

For a history of the Florida rulemaking effort, see *MWN*, J/A83, J/A84, M/A86 and N/D87.

NAS-NRC on ELF Mechanisms (continued from p.1)

the epidemiological studies as "interesting, but inconclusive," and Dr. Roy Shore advised that, "We need stable results that can stand up to scrutiny."

A number of experiments "beg replication," Shore said. But he added that there are limits to how much can be derived from further epidemiological studies and that if he had a budget of \$10 million, he would spend it on good animal studies.

Like Heath, Setlow characterized the epidemiological literature as "interesting, but not convincing." With respect to the need for mechanisms, he said that, "If the data were stronger, there would be less need for mechanisms; when it is weaker, you look for mechanisms." Overall, he said that progress has been made in the field since the last academy meeting in 1985 (see *MWN*, N/D85 and M/J86). Setlow, the associate director of life sciences at the Brookhaven National Lab on New York's Long Island, has a background in both physics and biology.

Dr. David Carpenter, one of the invited speakers, argued that, from a public health point of view, "There is a certain urgency" for sponsoring a "serious and forceful investigation," even though "we are a long way from understanding mechanisms." He said that animal studies were needed to find out more about the risks of brain cancer and leukemia associated with ELF exposure.

Carpenter and Dr. David Savitz, who reviewed the epidemiological literature for the panel, both warned that if there is indeed a cancer risk, the available data would tend to underestimate it because of the poor dosimetry used in past studies.

A report will be prepared by the panel, according to Dr. Ray Cooper of the NAS-NRC's Board on Radiation Effects Research, who organized the workshop. Setlow predicted that the board will hold regular biennial briefings on non-ionizing radiation in the future.

Members of the NAS-NRC panel are: Drs. Richard Setlow, chairman, Brookhaven National Lab; Clark Heath, American Cancer Society; Robert Pound, Harvard University; Regina Santella, Columbia University; Henman Schwan, University of Pennsylvania (emeritus); Roy Shore, New York University Medical School; and Eugene Stanley, Boston University. The invited speakers were: Drs. Martin Blank, Columbia University; Craig Byus, University of California, Riverside; David Carpenter, New York State Department of Health; Russel Reiter, University of Texas, San Antonio; David Savitz, University of North Carolina, Chapel Hill; and Tom Tenforde, Battelle Pacific Northwest Labs.

Florida DER-ERC Resolution

1. WHEREAS, the Environmental Regulation Commission [ERC] of the State of Florida Department of Environmental Regulation [DER] on January 18, 1989, adopted standards and requirements to reasonably protect the public health and welfare from electric and magnetic fields generated by transmission lines; and

2. WHEREAS, the Commission based its decision on a thorough review of present scientific data on the potential health effects of electric and magnetic fields, wherein it found that although there is no conclusive evidence that there is any danger or hazard to public health at the levels of existing 60 Hz electric and magnetic fields found in Florida, there is evidence of a potential for adverse health effects on the public, with further research being needed to determine the extent of the effects and the exposure levels at which the effects occur; and

3. WHEREAS, the Commission further based its consideration on the recommendations of the Department's EMF Advisory Panel, which recommended, among other things, that it would be prudent to keep the long-term exposure of 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.

NOW, THEREFORE, be it resolved:

1. The [ERC] encourages new electric transmission lines of 69 kV or greater to be sited in a manner that will consolidate such lines within existing corridors and that new corridors should be planned in coordination with land use plans of local governments in order to attempt to avoid placing corridors through residential areas.

2. This resolution shall be furnished to all local governments, Regional Planning Councils, and electric utilities in the state to assist their land use and siting plans.

RESOLVED before the [ERC] in Tampa, Hillsborough County, Florida, this 19th day of January, 1989.

Robert A. Mandell, Chairman

How Not To Revise the 1982 ANSI RF/MW Radiation Limits

This summer, the Bioelectromagnetics Society (BEMS) will present its highest honor, the D'Arsonval Award, to Dr. Ross Adey for his work on weak electromagnetic fields and their non-thermal effects. Although Adey won the support of the leaders of the society, not everyone is pleased. Dr. Eleanor Adair, for one, has resigned from the BEMS Awards Committee, charging that the decision will be an "embarrassment" to the society and that "his selection both demeans the award and denigrates the society." Many members of BEMS are astonished by Adair's charges.

Adair's work is on thermal physiology and she may have doubts about the existence of electromagnetic effects that have nothing to do with heating—she favored giving the award to Dr. Sol Michaelson, a loyal member of the thermalist school.

All this would only be a bad case of sour grapes if it did not raise serious questions about Adair's new role as co-chair, with Dr. Om Gandhi, of the subcommittee which is revising the 1982 American National Standards Institute (ANSI) limits for exposure to radiofrequency and microwave (RF/MW) radiation. In the absence of federal standards from the Environmental Protection Agency (EPA) or from the Occupational Safety and Health Administration, the ANSI limits have become the *de facto* U.S. standards and millions of Americans depend on them for protection at home and on the job.

The Adair-Gandhi subcommittee has now endorsed using a specific absorption rate (SAR) of 4 W/Kg as the threshold for ill effects in the revised standard—the same level as was used in 1982. In a February 2 letter to Dave Janes of the EPA, Adair wrote that she and Gandhi "agree that no further evaluation of the literature database is required to confirm the 4 W/Kg criterion."

The 4 W/Kg threshold was derived from studies by the U.S. Navy on behavioral disruption, according to Adair. On hearing this, EPA's Dr. Joe Elder responded that 4 W/Kg can kill an animal; he pointed out that SARs of 3.6 W/Kg are known to kill rats in a little over two hours. It is true that fur-bearing animals have different thermal regulatory systems than humans, but Elder also noted that rhesus monkeys experience "marked hyperthermia" at SARs of greater than 3.4 W/Kg and cannot tolerate SARs of more than 5.1 W/Kg for more than ninety minutes. He urged the subcommittee to "accept the dose rate of 4 W/Kg as the adverse effect level based on lethality in laboratory animals."

To be sure, ANSI builds in a safety factor—the 1982 exposure limits are based on an SAR of 0.4 W/Kg. But if 4 W/Kg can kill, what can the radiation do in more subtle ways and how much protection is warranted?

By retaining a 4 W/Kg limit, Adair and Gandhi appear to be disregarding a whole body of work that has appeared since

1982. The research is on both thermal and non-thermal effects and it indicates that 0.4 W/Kg is not protective.

In addition, there is no evidence that the subcommittee has ever discussed the potential RF/MW cancer risk—the subject of an ongoing EPA investigation.

With respect to thermal effects, EPA's Dr. Christopher Gordon has argued that when scaling from one species to another, differences in surface area are more important than differences in weight. According to Gordon's calculations, safety levels would have to be tightened by a factor of nearly ten to protect against the greater thermal insult.

When we reported Gordon's thesis two years ago, we quoted Elder as saying, "I expect there will be a lot of discussion of Gordon's paper in the bioelectromagnetics community" (see *MWN*, J/A87). This has not happened. That Adair has rejected Gordon's position is her prerogative, but she should nevertheless be encouraging a debate, not stifling one.

On the non-thermal front, the findings of Henry Kues of the Johns Hopkins University Applied Physics Lab and Jack Monahan of the Food and Drug Administration have serious implications: they have shown that pulsed microwaves can cause leakage in the blood-eye barrier of a monkey at an SAR as low as 2.6 W/Kg. When the eye is treated with glaucoma medicine the threshold is lowered to 0.26 W/Kg. How ANSI takes into account such synergy will be important to the more than two million Americans who use glaucoma drugs (see *MWN*, S/O86, J/A87 and J/A88).

The fact that the latest Kues-Monahan findings have not yet been published—the manuscript is in final editing—is immaterial. Both researchers are respected members of BEMS and they have presented a steady stream of results at the annual meetings. There is no doubt that the work is germane to health standards, so why is ANSI ignoring it?

Adair fears that giving the D'Arsonval Award to Adey will reflect badly on BEMS. This is nonsense. A much more important concern is how Adair's and Gandhi's actions on the ANSI standard will reflect on the bioelectromagnetics community if they fail to apply available knowledge to protect public and occupational health.

The "Commentary" column will be a regular feature in Microwave News. We invite our readers to write to us with their opinions.

MICROWAVE NEWS is published bimonthly • ISSN 0275-6595 • PO Box 1799, Grand Central Station, New York, NY 10163 • (212) 517-2800 • Editor and Publisher: Louis Slesin, Ph.D.; Associate Editors: Jennifer Goren, Sarah Verdone; Contributing Editor: Mark A. Pinsky; Copy Editors: Jim Feldman, Ann Hornaday • Subscriptions: \$250.00 per year (\$285.00 Canada & Foreign, U.S. funds only); single copies: \$50.00 • Copyright © 1989 by Louis Slesin • Reproduction in any form is forbidden without written permission.

CONFERENCES

New Listings

May 9-12: **7th DOD Conference on Directed Energy Weapon Vulnerability, Survivability and Effects**, U.S. Naval Postgraduate School, Monterey, CA. Contact: Donna Richard, Booz, Allen & Hamilton, Inc., 1300 N. 17th St., Suite 1610, Rosslyn, VA 22209, (703) 527-5429 (see p.12).

May 16-18: **8th Annual Conference on Properties and Applications of Magnetic Materials**, McCormick Centre Hotel, Chicago, IL. Contact: Prof. Messinger, Dept. of Electrical and Computer Engineering, Illinois Institute of Technology, 3301 S. Dearborn St., Chicago, IL 60616.

May 25-27: **Interaction Mechanisms of Low-Level Electromagnetic Fields in Living Systems-Resonant Phenomena**, Stockholm, Sweden. Contact: Dr. Hans Lundberg, Royal Swedish Academy of Sciences, PO Box 50005, S-104 05, Stockholm, Sweden, (46) 8-150430.

June 21: **Annual Meeting of the Society for Light Treatment and Biological Rhythms**, National Institutes of Health, Bethesda, MD. Contact: Dr. Daniel Kripke, Veterans Administration Medical Center V116A, 3350 La Jolla Village Dr., San Diego, CA 92161, (619) 453-7500, ext. 3436.

July 9-13: **8th Conference on Radiation and Health of the American Statistical Association (ASA), Health Effects of Electric and Magnetic Fields: Statistical Support for Research Strategies**, Copper Mountain Conference Center, Copper Mountain, CO. Contact: Marilyn Humm, ASA, 1429 Duke St., Alexandria, VA 22314, (703) 684-1221 (see p.12).

September 20-22: **Symposium on Antenna Applications**, Allerton Park, Monticello, IL. Contact: Y.T. Lo, Dept. of Electrical and Computer Engineering,

University of Illinois, 1406 W. Green St., Urbana, IL 61801, (217) 333-0293.

September 21-22: **39th Annual Fall Broadcast Symposium**, Hotel Washington, Washington, DC. Contact: Dr. Philip Rubin, Rubin, Bednarek Associates, 1667 K St., NW, Washington, DC 20006.

October 9-10: **21st Annual North American Power Symposium**, University of Missouri-Rolla, Rolla, MO. Contact: Dr. Charles Gross, Electrical Engineering Dept., Auburn University, Auburn, AL 36849, (205) 887-1812.

November 9-12: **11th Annual International Conference of the IEEE Engineering in Medicine and Biology Society**, Seattle, WA. Contact: Francis A. Spelman, Regional Primate Research Center SJ-50, University of Washington, Seattle, WA 98195, (206) 543-0440.

December 4-6: **International Conference on Magnetism and Magnetic Materials**, Rimini, Italy. Contact: Magis International S.r.l., Via Boccaccio, 19, 20123 Milan, Italy.

1990

January 3-5: **3rd International Interdisciplinary Research Conference on Fundamentals of Bone Growth: Methodology and Applications**, Los Angeles, CA. Contact: Dr. Andrew Dixon, Schools of Dentistry and Medicine, 63-090 CHS, University of California at Los Angeles (UCLA), Los Angeles, CA 90024, (213) 825-1761.

May 7-10: **IEEE 1990 International Radar Conference**, Marriott Crystal Gateway Hotel, Arlington, VA. Contact: Robert T. Hill, ITT Defense, 1000 Wilson Blvd., 30th Fl., Arlington, VA 22209.

CLASSIFIEDS

VDT NEWS

"Recognized for its authority on health and safety issues"
— Fortune Magazine

1-year subscription (6 bimonthly issues) for \$87.00 (\$97.00 Canada & Foreign).

___ back issues, 1984-1988, \$45.00 per year (\$50.00 Canada & Foreign).

Order from: *VDT News*, PO Box 1799, Grand Central Station, New York, NY 10163, (212) 517-2802.
[U.S. Funds Please]

Name _____
Institution _____
Address _____
City _____
State _____ Zip _____

Order Microwave News

1-year subscription (6 bimonthly issues) for \$250.00 (\$285.00 Canada & Foreign).

6-month trial (3 bimonthly issues) for \$130.00 (\$150.00 Canada & Foreign).

___ back issues, 1981-1988, \$95.00 per year (\$100.00 Canada & Foreign).

Order from: *Microwave News*, PO Box 1799, Grand Central Station, New York, NY 10163, (212) 517-2800.
[U.S. Funds Please]

Name _____
Institution _____
Address _____
City _____
State _____ Zip _____